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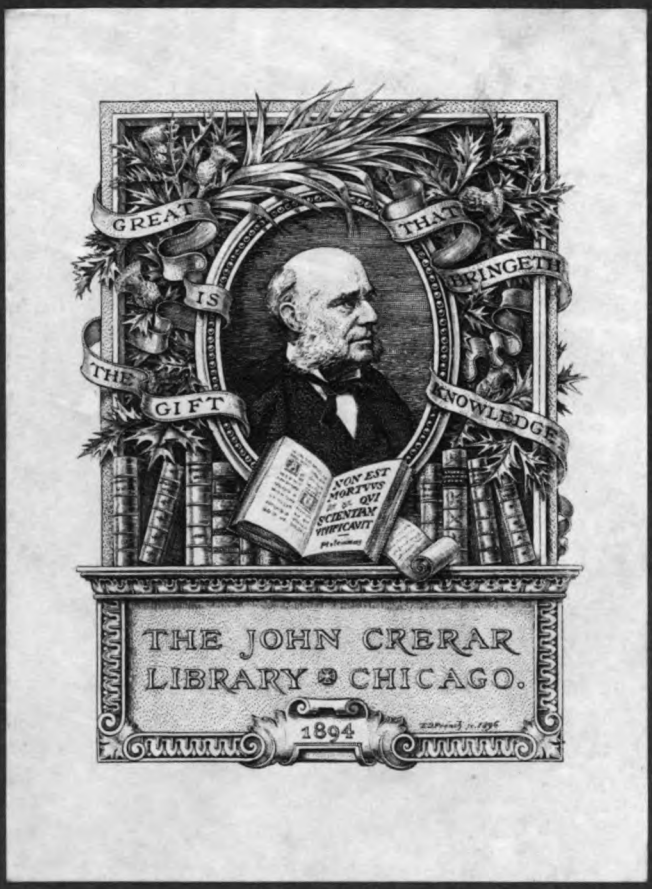

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NAPOLEON I.

In May 1921, a great French Marshal an ex-Artilleryman is making France's military arrangements to force Germany to comply with the Peace Treaty.

On the 5th May, 1821, Napoleon I., Emperor of the French, also an ex-Artilleryman died at St. Helena.

In the fame he attained as a Statesman and as a leader of Armies the eight years he served in the Artillery are apt to be forgotten.

It seems fitting, that the Officers of the Artillery who have fought side by side with the French for over four years should pay their tribute to the memory of one of France's greatest sons.

Perhaps British officers who wear the French "Croix de Guerre" do not know that the ribbon they are wearing is identical with that issued by the French Government in 1857 to commemorate Napoleon's campaigns of 1792—1815.

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SUBMARINE WARFARE.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 22nd February, 1921.

BY COMMANDER G. P. THOMSON, O.B.E., R.N.

Colonel D. J. M. Fasson, C.B., C.M.G., in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, May I introduce to you, Commander Thomson who is going to lecture to us? The title of his lecture, "Submarine Warfare," is, I think, undoubtedly, in itself, sufficient guarantee that the subject is a very interesting one; in fact I think it would be difficult to name a more interesting one. I feel sure that many of us during the war, when we were thinking, talking and hearing so much about submarine action, would have been very glad if we had had a lecture of this sort before the war; but the next best thing is to have it now. I am quite sure we are going to learn a tremendous lot, because I may tell you that what Commander Thomson does not know about submarines, is not worth knowing. He has been all his service with them, and, of course, including the war. Of course incidentally what we hear to-night will help us very much to take an intelligent interest in that great newspaper controversy: Submarines against battleships. Commander Thomson has very kindly said that he will answer any questions that you may like to ask at the end of the lecture. I will now ask Commander Thomson to proceed.

COMMANDER THOMSON: Mr. Chairman, Ladies and Gentlemen, I have come here to-day to try to tell you a little about submarines, the principles on which they work, what they did in the late war, and what they are capable of doing now. My first idea was to talk to you rather than read out a paper, because it always seems to me that anything read out is a bit boring; but on the other hand I have only a limited amount of time at my disposal and if I talked to you I would spend a lot of time home hemming and hawing; so I thought it best after all to read my lecture out to you, and risk being dull.

I propose first of all to give you a brief description of how a submarine functions, as some of you may otherwise have difficulty in understanding the rest of my lecture.

The proper way to look upon a submarine is to consider her as a type of surface vessel which has an enormous advantage over other types, in that she has the power to submerge at will. It is true that in order to obtain this advantage she has to make many sacrifices, but as time goes on these sacrifices are becoming ever less, until you have to-day people who talk about the possibility of the submersible battleship.

There are, again, many types of modern submarines, the uses of which I shall discuss later, but four main principles of working are common to all.

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Firstly, in order to submerge, water is let into tanks placed around her hull, and also inside the boat along the lower half of the hull, until the upward force of buoyancy is almost neutralised. The boat is then in what is called "diving trim," and by going ahead and using the hydroplanes, which is simply another name for driving rudders or horizontal rudders, she is forced under water, and kept at the required depth. Often in emergency, or by mistake, too much water is let in. The boat then does not require forcing under, but sinks, and has to be held up at the required depth by means of the horizontal rudders. She then has what is called negative buoyancy.

Secondly: To come to the surface again water is blown out of these tanks by means of compressed air from the main air service system.

By the main air service system I mean an air pipe on to which a large number of air bottles or vessels are connected containing air at 2,500 lbs. pressure per square inch.

Thirdly: When submerged the crew of a submarine exist on the air that was in the boat at the commencement of the dive. No oxygen is necessary, because the existing air is sufficient for any dive one is likely to do. The limiting factor of a boat's underwater endurance is not the air, but the capacity of the storage batteries supplying the electricity for the motors, for she must keep going ahead if she is to maintain a steady depth line. If she stops she either comes to the surface or sinks to the bottom, according to whether she is trimmed with positive or negative buoyancy. I think that is perfectly clear.

Fourthly: All submarines at the present day must have two methods of propulsion, one for surface work and another for use under water. From what I have just said, it is obvious that the engine used under water must be one that does not require air, as part of its fuel, and the one universally adopted is an electric motor, obtaining its power from energy stored in secondary cells. When the submarine is on the surface, and can thus obtain an unlimited quantity of air, the ordinary motive power of ships is used, that is, internal combustion or steam engines.

These four principles, then, are common to all submarines, no matter what type they are or to what nation they belong. There are various technical details as to handling a submarine, which I do not propose to go into here, because they would only confuse you and are, besides, unnecessary if you have thoroughly grouped these four main principles.

A few words now as to the uses of submarines. There are a great number of foolish people to-day who claim that a submarine can do everything. There are likewise a great number of equally foolish people who say that submarines are not much use, and that as soon as we really got our anti-submarine measures going properly in the late war, the submarine was beaten hopelessly.

Both these views are entirely wrong. Legitimately used, in accordance with International Law, the submarine, though forming a very powerful factor in naval warfare, has none the less many limitations at the present day. Whatever the future may bring

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forth, we have not yet reached the stage when submarines alone can carry out the four main duties of a fleet. These may be described as follows :—(1) To ensure for our merchant ships the unimpeded use of the seas.

(2) To deny the use of the sea to enemy merchant ships, and thus by economic pressure compelling him to make peace.

(3) To cover the passage of an army overseas and to protect its communications.

(4) To prevent invasion of this country or its Dominions.

None of these objects is capable of attainment, at any rate at the present day, by submarines alone, if they are legitimately used. On the other hand, in the late war, Germany very nearly defeated us when she used her submarines against our trade in what was called her unrestricted submarine warfare.

This, however, was quite an illegal use, because by International Law ships must first be searched and the crews removed before being sunk, and this, of course, the Germans omitted to do. None the less, it is assumed by many Naval Officers that any future enemy will use her submarines in a similar manner, because by so using them they are adopting the best plan to make England sue for peace. As a result of this reasoning we have had a great deal of discussion and articles in newspapers as to the respective merits of battleships and submarines. "If" says one party "your battleships cannot prevent submarines holding up our trade, what is the use of building battleships? "If" says the other party, "you have not any battleships, who is going to protect your submarine bases?"

You must remember in connection with the German submarine campaign, that their submarines were defeated in the end, not so much by our anti-submarine measures (good though they were), but because of the geographical position of England and Germany, which enabled us to mine their exits, and the channels through which they had to pass, and adopt other measures to confine them within restricted areas. This would not be possible in a war with a far distant country, for our lines of communication, trade routes, etc., will extend to thousands of miles thus rendering mines and many other anti-submarines measures used in the late war next to useless. I shall speak about this later. Another reason for the defeat of the German submarines was their lack of boats, and still more their lack of experienced officers. That is really the main reason why they were defeated. They never had more than 20 boats at sea at one time. Germany before the war had not realised the power of a submarine. Admiral Scheer, the Commander-in-Chief of the German High Sea fleet, in his book relates how delighted the German authorities were when out of six submarines sent out in August 1914, on a week's trip to the Scottish Coast, four came back safely. That is to say they lost two out of six and were quite pleased about it.

I shall now turn to the legitimate uses of a submarine, in most of which she was employed by us during the late war. They are all made possible by this fundamental truth : "A submarine can in all her operations act unsupported, being able to break off action whenever she wishes." Briefly the legitimate uses may be summarised as

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follows :—(1) She can carry on a blockade a long way from her base arriving and remaining on her station unseen. (2) She can torpedo surface ships irrespective of their fighting capacity. (3) She can watch the enemy's movements and report them, leaving the enemy with only an intercepted Wireless signal as a ground for belief that they have been under observation. (4) She can be used with a battle fleet for shadowing the enemy, attacking him if he attempts to turn away from the fighting line, delaying his advance if he is the stronger fleet, scouting for own fleet, and many other duties usually carried out by light cruisers and destroyers. (5) She can lay mines unknown to the enemy. (6) If she is heavily gunned she can, due to the element of surprise and her low free board, fight short actions against enemy surface craft or coastal defences. Naturally any one type of submarine does not possess all these virtues. Some of these duties need high surface speed and large surface endurance, others need large underwater endurance and medium speed on surface, others again need heavy guns, and so on. By the end of the war we had evolved four distinct types, K, L, M and Improved H, which you may consider as being able between them to carry out all the duties required of a submarine at the present day.

Before I tell you of some of the experiences undergone by our own and enemy submarines during the war, I think perhaps I should give a brief history of our submarines leading up to these classes.

Though a submersible vessel had been designed as early as 1580, it was not till the end of last century that a submarine showed any likelihood of being of any practical use. After much pressure the British Government in 1900 ordered 5 submarines to be built from American design. These were Holland boats, 64 feet long, with one torpedo tube; a small petrol engine gave her a speed of seven knots. Tiny little things they were, but they formed the basis of design for our submarines for many years, and in them our senior submarine officers received their early training. A, B and C boats followed the Holland type. They were simply improvements on the Holland boat, with far greater speed, offensive power, and radius of action, particularly the B and C boats. In fact the B and C boats were essentially sea-going vessels as opposed to the purely harbour defence qualities of the A and Holland boats and were intended for North Sea work.

In 1907, a marked divergence in submarine design was introduced by the D. Boat, which had two Diesel engines, instead of one petrol engine, and her principal ballast tanks placed outside the hull. She was by her endurance and habitability capable of remaining a considerable number of days at sea. It was only then that the Germans thought of submarines. When they saw that we had a submarine that could work overseas, they began to think that it might be a good thing to build them. Many experiments were carried out with the first D boat, and after building eight of them, a larger and improved boat, but with the same characteristics, was evolved. This was the E boat, and was the boat we chiefly used in the war. Its legitimate exploits in the Dardanelles and elsewhere I think have made it as famous, as the illegitimate deeds of the German U boats have made the name of the latter infamous throughout the world.

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At the outbreak of war we had nine E class and eight D and, it was on these 17 boats that the work of patrolling the Heligoland Bight devolved at that period. The 47 B and C boats we had then were not suitable for oversea patrol work, and were used for local patrols and defence of coasts and harbours only. Many more E boats were at once ordered, and furthermore the boats of foreign design on which the Admiralty had been experimenting, Fs, Ss, Vs and Ws were completed in the early part of the war. These boats had an outer hull of very thin plating and though they were used for oversea patrol work, were not a great success, and their design was discarded. Their best points were taken, however, and embodied in the G and J boats. The latter were 19-knot boats of 270 feet length, and were built originally with the idea of proceeding to sea with the Grand Fleet and taking part in the expected fleet action. Long before they were completed, however, it had been realised they were too slow to work with the fleet, and they joined in the patrol of the German coast. 20 H class boats, of American design, had been ordered from America in 1914. The first ten, after completion, were not allowed to proceed to England, America considering that it would not be a neutral act on her part if she permitted them to sail. The difficulty, however, was got over, for the remaining 10 boats, by sending the various parts to Canada and assembling them there. These boats were about the size of the D class, and were very suitable for North Sea Patrol work. In the latter half of the war the H boats and E boats were both enlarged and vastly improved and called improved Hs and L boats respectively. That is to say the L boat is simply a large E. These two classes, the improved H and L, have come to stay, and form part of our submarine flotillas at the present day.

To sum up then, we had Ds, Es, Fs, Gs, Hs, Js, Ls, Ss, Vs, and Ws, all doing oversea patrol work during the war, and though we still keep a good many of these different types in reserve to-day, I may safely say that only Ls and Hs will remain as the standard for future types of patrol boats.

The first K boat was commissioned on August 4th, 1916, as a result of urgent representations on the part of the Commander-in-Chief Grand Fleet for submarines to work with the fleet. They are 340 feet long, and are propelled by turbine engines, using oil fuel boilers. They have afforded us valuable data for our future fleet submarines, and though it is unlikely that any more of this type will be built, it is very necessary that they should be kept in commission to give us experience in handling large boats.

There are many technical objections to a steam submarine, apart from its heavy fuel consumption. But the Commander-in-Chief wanted 24 knots for his fleet submarines and our Diesel engines would not look at that speed. Our Diesel engine development at that time was limited to 100 h.p. per cylinder, though the Germans had reached 300. However, our engineers promise us great things in the way of an internal combustion engine, which will undoubtedly be used for future fleet submarines in view of the great objections to steam.

The Ks are the only steam-driven submarines in the British Navy, and if any of you come across one, it will be well worth your while

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to go over it, as they are a very wonderful invention. It is a pity they were not completed for the battle of Jutland, for the Germans afforded us no other chance of using them. They were designed to attack the German fleet as it retreated to its base. Our Commander-in-Chief was convinced that the German fleet, if he succeeded in coming to grips with it at all, would not fight to a finish, but would turn away from the line of battle as soon as it could find a convenient opportunity. He intended the K boats as a counter to this manœuvre. He put them in such a position that they could intercept the German ships as they left the battle line.

The M class did not arrive till almost the end of the war, and consequently were not able to show what they could do. They are fitted with a 12″ gun as well as a good torpedo armament. They can rise to the surface, fire a round and dive again in a very short space of time. I am not allowed to say what it is, it is confidential. Besides making good oversea patrol boats they can be used for fighting short actions on the surface with hostile light forces. Experiments are still being carried on with them, as it is recognised that the Ms have many future possibilities.

Summing up our modern submarines then, we have, the K class, to work with the fleet. They have very high speed.

M class, for sending out on independent cruises to annoy the enemy's ships and bombard his coast.

L class, for oversea patrol, blockade work, and laying mines. Being habitable with large surface endurance, and medium speed, they can go to any part of the world. In fact we have 12 of them in China at the present moment.

Then there is H class, about 165 feet, 400 tons, the modern coastal defence submarine, small but suitable for general work, and can go anywhere provided they have not to remain at sea more than 10 days or a fortnight.

There is very little to say about German submarines, because they stuck to one or two types which they standardised for the sake of rapid construction. They had U boats, UB boats UC boats, and U cruisers. Briefly the U boats up to U40 resembled our E boats. From U40 onwards they were about the size of our Ls. They had two types of UBs, and UCs, the one about the size of our D class (that was the first Diesel submarine we had) working from Germany, the other quite small boats, somewhere between our As and Cs, and they worked from Flanders. The UCs were primarily meant for mine-laying, though the larger type carried 4 torpedoes also. The U cruisers were very large boats, somewhere in the neighbourhood of our Ks. These vessels were armed with two 6″ guns and carried about 30 torpedoes, doing cruises which lasted up to three months. The U boats voyages, however, lasted only about 21 to 28 days. Our own boats used to do cruises of from 10 to 12 days, except the boats that were working in the Dardanelles, E boats, which used to remain a month at sea. During the war I had a notion that the German submarines were better than ours, but now that I have seen the inside of U boats I have changed my mind. They paid more attention perhaps to small matters of detail, but on the whole I do not think

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the German U boats were anything like as good as our Ls, for example. As for the U cruisers they were comparative failures. The only way in which the Germans were ahead of us was in the Diesel engine. Their cylinders had three times the H.P. of ours, consequently they had a very much smaller and better running engine than we had for a given speed.

The Germans had about 30 U boats at the beginning of the war. At the time of the armistice they had lost 200. Another 200 were in commission or just completing, and 135 more were on the building slips. Further they were expecting to turn out about 20 to 30 a month in 1919. It may be seen from this what an intensive effort they intended to make in that year. Their total losses in submarines were 50 per cent. of their strength. Our own losses were about 30 per cent. and these were chiefly due to mines. Of course, our submarines really did not have much chance.

Up to the end of 1916, the primary duty of our patrol submarines was to torpedo any vessel, entering or leaving the Bight. In the very early days of the war they used to hang about off the German rivers, and though they seldom saw anything bigger than patrol vessels they obtained a great deal of information. Later on, the minefields began to thicken, and the submarine patrols were brought outside Heligoland. Our submarine minelayers, however, went right inside the Bight throughout the war, and caused many casualties to the German mine-sweepers which always escorted the U boats clear of the minefields. At the beginning of 1917, our patrol submarines, were fitted with long range wireless, and had special orders never to attack an outward bound ship, but instead they were to let the enemy pass them, and come to the surface as soon as possible afterwards, and make an enemy report by wireless to the Commander-in-Chief. Thus the patrol submarine definitely became a strategical unit of the Grand Fleet, being primarily used as a scout. It was very hard on the submarines, but it was good strategy, for though a submarine attack meant the loss or damage of one enemy ship, a submarine report by wireless might have meant the chance which the Grand Fleet waited for. for so long: the cutting off of the whole of the enemy fleet. If a submarine attacked, it either meant the enemy fleet returning to harbour or else enemy destroyers hunting the submarine and thus preventing her rising to the surface to make the report. The submarine was of course still allowed to attack the enemy when returning, for a wireless report would then have been useless.

At the time of the battle of Jutland, we had none too many oversea submarines to spare, consequently we had then only 3 or 4 patrolling off the Bight, none of which sighted the German fleet. Gradually, however, our patrols were increased, and on the next two occasions the enemy came out, in August and November 1916, one of our submarines met them and torpedoed one battleship on the first occasion and two on the second. From the beginning of 1917, to the end of the war, when the "reporting" orders were in force, (orders I have just spoken about) we had the exits from the Heligoland Bight watched by submarines which were so placed that our Commander-in-Chief reckoned that the High Seas Fleet could not come out without

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being reported. Unfortunately the Germans only gave us one chance to prove this theory, in April 1918, which was the only occasion on which they left the Heligoland Bight throughout a period of 2 years—November 1916 to November 1918. This expedition was undertaken to intercept a convoy coming from Norway to Scotland, and incidentally to wipe out a supporting force of battleships which we kept on that convoy route. The enemy achieved nothing, partly because their intelligence in regard to our convoy movements was faulty, but chiefly because one of their battle-cruisers, the *Moltke*, lost a propeller, and was only able to go slow, so, when off the South-West corner of Norway, they decided to return. You must remember that the German expeditions resembled the pastime of the schoolboy who rings the bell and runs away, and were undertaken partly to show that they could go to sea, and partly in the hope of cutting off portions of our forces. This occasion, however, served to prove that our Commander-in-Chief's theory was correct. The German fleet was seen by one of our submarines, a J boat, on its way out. Unfortunately our boats had up till then usually been informed if any of our own ships were to be in the vicinity of their patrol area, and this particular boat had just been informed by wireless that some of our large ships were to be passing through her area. As the time tallied with that at which she saw the Hun Fleet, or within an hour or so, she assumed, owing to bad light and mist, that the latter were British vessels and so she didn't report. Another submarine, however, torpedoed the damaged *Moltke*, as she was returning to harbour. Further work undertaken by our submarines was the torpedoing of enemy submarines, 18 being accounted for in this manner. This kind of work was considered part of every submarine's duty, even if their particular job was watching for the Hun Fleet. But we always kept a large number of submarines at sea especially for this duty, in the Atlantic, Mediterranean, Channel, North Sea, etc. Many more Hun submarines would have been at the bottom of the sea to-day if we had had better long range torpedoes. Time after time they broke surface after being fired at a Hun submarine, due to their being set to run at a shallow depth. Against a big ship, set to run at 16 to 18 feet, they were all right—but against a submarine, when the depth setting had to be 8 feet or less, they caused bitter disappointment to our submarine officers. A submarine on the surface becomes, as I have said before, a surface ship, and can be torpedoed as such by another submarine submerged, but owing to her low freeboard she is not seen from afar through a periscope, and the attack has to be made under very difficult conditions. The essence of a successful submarine attack is a correct estimation, first of the enemy's course, then of her speed, both of which are extremely difficult to obtain when attacking a submarine, owing to the shortness of time between first sighting her and firing at her.

Let me now give you a few experiences undergone by our submarines during the war.

I shall first deal with an uneventful patrol trip of from 9 to 12 days, because this kind of trip was the usual one experienced by our boats throughout 4 years of war.

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On arrival at her patrol area, usually an hour before sunrise, the submarine dives, adjusts her "diving trim" by means of the small auxiliary tanks she has for the purpose, until very little movement of the horizontal rudders is necessary to keep a steady depth line. She then starts patrolling, with her periscope showing one or two feet above water. One officer remains at the periscope, and four or five sailors remain on watch to look after the motors, bearings, steering rudders, diving rudders, etc. The others go to sleep or read. There is very little for the crew to do when patrolling, and in any case hard work is discouraged because it uses up air. The air is kept circulating by fans and in addition most boats used air purifiers, which are excellent for keeping the air decent. With purifiers running, I used to allow my crew to smoke cigarettes, which I found eased the monotony of patrol work a great deal. All meals under water are cold—cooking, which is all done by electricity,—is deferred till night time, when the boat comes to the surface. This she does, when nothing more can be seen through the periscope, to charge her batteries, an operation lasting from 4 to 5 hours. One motor—driven by the engine—is used as a dynamo for charging, with the propeller clutch out; the other is kept instantly ready in case the Officer of the Watch on the bridge presses the button working the electric alarm. This alarm makes a fiendish noise, and would wake the dead from sleep. At its sound, the tanks are flooded immediately, for it means an enemy destroyer or some other vessel is going for you, and a few seconds may mean whether you are "done in" or not. As a rule a boat is kept on the move with one engine when charging, in order that she may get under water more quickly. A simple matter of slipping out the engine clutch, and switching on the motor field makes the motor (which was till then running light on the shaft) ready for diving the boat with. After the batteries were charged, submarines used to go to the bottom for the remainder of the night, but when the "reporting orders" were in force, from 1917 onwards, it became necessary for them to remain on the surface all night. This considerably increased the hardship and tension of an oversea patrol, for a patrol submarine hates being on the surface. She is at the mercy of any Tom, Dick or Harry who comes along. It was so perfect to be able, about 9 or 10 o'clock on a winters' night, after the batteries had been charged, to retire to the bottom at 130 feet and feel that you need worry about *nothing* till next morning. Every one undressed and turned in, except one watch-keeper, whose job was a sinecure.

This, then, was the average daily routine of our patrol boats: looking for targets and seeing nothing. Happily all trips were not quite so monotonous as this. Take for instance H.5s; her Captain's report on return to harbour being as follows:—"11th July, 1916; Fixed position by Terschelling Light." That as you know is an island on the Dutch coast. "Proceeded towards Ems. 14th July, 12.34 a.m. Dived—several destroyers in sight. 10 a.m. Sighted and attacked hostile submarine. Torpedoed submarine amidships. Came to surface to look for survivors. Put down by a destroyer 10.41 a.m. Altered course North and went to bottom at 100 feet. Heard loud explosions, one very heavy one. Many vessels sweeping for us. On

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one occasion, a sweep wire scraped the whole length of the boat along the port side, and a vessel was heard to pass directly overhead."

I may mention in connection with this report that the Captain of H.5 got bored with the patrol area assigned to him, and took a voyage on his own inside the Bight into the mouth of the Weser River. The Admiralty very rightly censured him at the time, but a year later—also very rightly—gave him the D.S.C. for torpedoing the Hun submarine.

S.1's experiences in June 1915 were, to say the least of it, interesting. On the 21st she was ten miles North of Heligoland. During the day she sighted a Zeppelin, a seaplane and nineteen trawlers. She also fired at a destroyer and missed. That night her port engine broke down completely. On the 22nd she sighted a Zeppelin and a Parseval, whilst diving. On the 23rd the starboard engine also broke down completely, and a Zeppelin was in sight all day. On the 24th whilst diving she sighted the German trawler Osl. She came to the surface, captured the trawler, put a prize crew of 5 hands under an officer on board, and made the trawler tow her back to Yarmouth, and in spite of the fact that the trawler's engine broke down twice and had to be refitted by S.1's crew, the comic party got safely back.

German airplanes began to be very active in 1918, as is shown by the following report of E.56:—"23rd May 1918, 1 a.m.; South Dogger Bank Light Vessel bearing North 3 miles; 4.30 a.m. sighted Zeppelin long way off; 10 a.m. sighted seaplane in periscope 2 miles on port beam coming towards me—dived to 60 feet. Altered course to West. 10.15 one bomb—dived to 90 feet; 10.45 came up to periscope depth and continued patrol; 6.20 p.m. three bombs—dived to 80 feet; 6.37 three bombs—altered course to N.E. depth 70 feet; 6.50 one bomb; 7.37 p.m. depth 80 feet, six bombs close to boat. He gets clear of his pursuer and continues his patrol without incident, till May 26th, 4.45 a.m. Sighted seaplane—dived to 70 feet; 9 a.m. sighted seaplane and dived to 80 feet; 9.38 five bombs dropped; 12.15 one bomb dropped. Heard propellors which passed on. 4 p.m. two bombs dropped; 4.20 one bomb dropped; heard propellors and sweep: 4.40 two bombs—propellors and sweep; 6.20 one bomb a long way off.

I might mention here that both British and German submarine officers have a very poor opinion of aircraft as a destructive anti-submarine weapon. They were, however, useful in locating a submarine on the surface, after which the submarine might just as well clear right out of it for all the use she was there, as no target worth a torpedo would come near the spot. Besides, the aircraft report invariably brought hosts of surface patrol craft to hunt the submarine.

C.24's report is interesting from the point of view of the work she was doing, and the difficulties she had to contend with at the time. In 1915, owing to U boats attacks on our fishing fleet, we conceived the idea of towing a submarine from a trawler, using our local defence submarines for the purpose. To the outside world, the trawler looked as if she were carrying on her ordinary trawling duties. She was in telephonic communication with the submarine, which was out of sight at a depth of 30 to 50 feet. The submarine was fitted with a special

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arrangement so that she could slip the tow from inside the boat, and whilst she was manœuvring into position for the attack the trawler's job was to show every sign of panic on sighting the U boat, and abandon ship. As a matter of fact she had a concealed gun in case things got too hot for her, and our submarine made a mess of things.

The Captain of C.24's report ran something like this:—"9.30 a.m. Trawler telephoned: 'submarine 1,000 yards astern.' I gave the order to slip the tow, but the slipping gear jammed, (of course, it would) so I telephoned to the trawler to cast off her end, which she did. The boat immediately sank to 38 feet with 5 degrees inclination, bow down, owing to my having 100 fathoms of 3½″ wire hawser, 100 fathoms 8″ hemp hawser and 100 fathoms of telephone cable hanging from my bows. Consequently the trim took some time to adjust: eventually sighted enemy's conning tower 1,000 yards off. Closed to 500 yards and fired at 9.55 a.m. Torpedo hit enemy amidships. I then come to the surface and picked up U.40's Captain. My propeller now refused to move, and it was found that there were 26 turns of telephone cable round the shaft."

As I have said, our Minelaying submarines laid mines in the Bight, off the German rivers, etc., right throughout the war. It was essential that these mines should be laid with great accuracy, for not only did the enemy keep to very narrow channels, but our boats had to dodge between our own minefields and the enemy's minefields, which left very little safe water for our minelaying submarines to go in and out. We endeavoured when possible to lay mines in the Channels after the Germans had swept them, and achieved a good deal of success in this way.

E.41 for instance, having just laid her mines in a swept Channel, sighted a German merchant ship approaching, well escorted. E.41 torpedoed the ship and was promptly chased by the escort. E.41's only exit was through the minefield she had just laid, so she dived deep and went through it without mishap.

This case shows another great advantage about a submarine. If the whereabouts of an enemy minefield is known, a submarine can got through it by simply diving deep and going underneath it, whereas an ordinary surface craft has to have it swept beforehand, and this is very often impossible.

Besides our submarines in the North Sea, we sent boats, as you know, to the Baltic and Mediterranean. The two boats E.1 and E.9 sent to the Baltic late in 1914 did a great deal of damage, torpedoing two big cruisers, a destroyer and various transports, besides causing the abandoning of the German attack on Riga. Later on, aided by more E. boats, they frequently caused the holding up of all merchant traffic between Germany and Sweden, but their usefulness ceased, of course, at the outbreak of the Revolution.

The exploits of the submarines in the Sea of Marmora are probably familiar to you all. They accounted for the majority of the vessels sunk by our submarines during the war, which amounted to 54 warships and 274 other vessels.

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I shall conclude my selection of submarine experiences by an account of the sinking of E.7, because it will show you how a well-trained crew can stand up to the deadly effect of depth charges, the most efficient anti-submarine weapon used in the late war. To get into the Sea of Marmora, our boats had to pass through a fairly heavy net barrage. It was a toss up whether they got through or not; and on this occasion E.7 did not get through, as you will see from this account. I shall quote from her Captain's report starting from the time of E.7's arrival at the net. "7.30: Sighted buoys supporting submarine net off Nagara Point; diver to 100 feet and increased to 7½ knots. The bows cut through the net as the starboard propeller fouled and stopped the starboard motor. Put helm hard a-port and increased to full speed with port motor. Boat fell off to port and lay parallel to and much entangled in the net. I tried to turn boat's head to South and pass through the net. 8.30 a.m. A mine exploded a few hundred feet from the boat, no damage being done. After about two hours manœuvring the boat was turned to the Southward and repeated attempts to get clear were made at depths between 60 and 130 feet by going full speed ahead and full speed astern. Boat was now held by the net fore and aft. 10.30 a.m. A mine was exploded close to the boat. The explosion was violent, but no damage was done to the hull. After this explosion the boat was much freer than before and in the hopes that further attempts to blow up the boat might result in completely freeing her, I decided to remain submerged till after dark, when it might be possible to come to the surface and clear the obstruction. Burned all confidential papers. By 2 p.m. Battery power was much reduced, and further attempts to get clear were given up for a time. 6.40 p.m. A mine was exploded a few feet from the hull; the explosion was very violent, electric lights and other small fittings being broken. The motors were at once started in the hope that the net had been destroyed, but this was not the case. The presence of enemy craft on the surface having made it impossible to come to the surface after dark and so clear the obstruction, I decided to come up and remove the crew before blowing up the boat." It was brought to the surface without difficulty and when the conning tower was above water Lieutenant Scaif went on deck to surrender the crew. The report then deals with the successful blowing up of the boat after the crew had been taken off in Turkish motor boats. I have quoted extracts from it to show you what a well-trained crew can do. Many a German submarine has come up and surrendered as the result of one depth charge alone, without any actual damage being done to the boat, and without any actual necessity. I have mentioned most of the anti-submarine measures in the course of my remarks. Mystery Ships you have all heard about, but ther usefulness almost wholly ceased when the Germans took to torpedoing our merchant ships instead of rising to the surface to sink them by gunfire.

Depth charges were and still are a very efficient anti-submarine weapon, though to do actual damage to a submarine they must explode very close to the hull, which is, of course, the exception rather than the rule. But their moral effect is tremendous, and it needs a well trained officers and crew to experience them often without going on the

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sick list with nerves. All kinds of nets were used against submarines. There was the heavy net of 3 to 4″ wire, which was supposed actually to prevent a submarine's passage. The net in the Dardanelles was of this description, and as we know most of our boats did get through it.

There were light nets with mines in them, the idea being that the submarine on hitting the net, should cause it to give and so draw the mines in on each side of it. Then there was the indicator net of very fine wire which the submarine carried away on hitting it, at the same time dragging along a section of the net in which it was entangled. At the surface on each section there was a buoy, which the patrol craft simply followed as the submarine dragged it along.

I think I have said enough to show you that the submarine is a very important factor in naval warfare. When the late war started, the submarine was only in its infancy, but even so the Germans very nearly defeated us with it, and we ourselves were able to carry out an effective blockade of the German coast by using submarines as close watching ships. It is recognised now that only a submarine can carry out the duties of watching closely an enemy port or coast; hostile submarines make it impossible for any other ship to do so. But in future wars—I may say in any war of the immediate future— we shall see submarines carrying out many of the duties up to the present undertaken by cruisers, such as commerce warfare, shadowing a fleet, reconnaissance work, and other work of a more or less offensive nature. For defensive duties the submarine will always take second place when compared with the surface ship proper, for the former, that is to say the submarine, in order to obtain the power to submerge, will always have to sacrifice some of its surface qualities. For that reason the ship that must always remain on the surface, that is the surface ship proper, will be more powerful on the surface than the ship which is able to submerge. The submarine, as I have said, has already taken over some of the duties of a cruiser and as time goes on will eventually, I am convinced be the cruiser of the future. But until a submarine by its offensive power under water can prevent a battleship from going to sea, you will always need to have battleships to give the final decision. In the late war, battleships had to steam at high speed, and be well escorted, on account of submarines, but they were still able to go to sea for a definite object. It was too risky for them to cruise aimlessly about, but they were not prevented from going from A to B, though if British submarine officers had been in German submarines our battleships, in going from A to B, would have suffered much more loss than they did. But if they are prepared to suffer losses in the future, I do not see any immediate prospect of the submarine being able to keep them in harbour. In the dim future this may be the case, but for the present is it not so.

Finally I think it may be assumed that the submarine will be of greater use to our enemies than to ourselves. For example, in the rôle of a submersible commerce destroyer, she is going to give us a very difficult problem to tackle. A craft which is armed with 6″ or 7·5″ guns, and is practically independent of bases, a craft which can remain at sea for five or six months at a time, and which simply submerges when you send surface forces against it, is going to take a

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lot of rounding up. Our existence, as you know, depends very largely on our commerce, so that this new problem must be kept ever before us. None the less it is only an addition to our other tasks and must not blind our eyes to the importance—to the necessity—of our battle-fleet on which the security of the Empire depends.

The battleship for us is paramount, whilst the submarine remains a useful and powerful unit of our Navy.

DISCUSSION.

THE CHAIRMAN: Would anybody like to ask a question?

COLONEL CRAIG: The Lecturer did not deal with the location of submarines; he mentioned incidentally they were spotted by aeroplanes and seaplanes, but he mentioned no other way of locating them. I do not know whether he is bound by secrecy or not with regard to that matter.

COMMANDER THOMSON: The whole thing is that there is no method of locating a submarine really. People who are against submarines always try to make out that you have got hydrophones and various other things to locate them, but they are really no good. The whole point is that when the war started both submarines and anti-submarine measures were like new born babies. They had just started. The submarine has now got on, and has now become almost—well, he is a very big fat schoolboy; whereas the anti-submarine measures are where they were. We have not got any for'arder. Till you get something to replace the eyes, to give you a range visibility corresponding to your eyes, we must admit that the submarine does defeat us. You cannot locate it. In narrow waters perhaps you can confine it a bit, and you can keep it down, but it is impossible really to locate a submarine. The anti-submarine measures are not advancing at all well; and really it is up to the Government to spend as much money as they can, not so much on submarines as on anti-submarine measures, although they will be extremely difficult things to get.

COLONEL WHITE: I am not quite sure about what the Lecturer said on the subject of the supply of air to the crew. How do they manage for air? I understood him to say they did not need any supply of air, but the air in the submarine when it dived was enough to keep them going.

COMMANDER THOMSON: Yes, that is right; we do not have anything outside the supply of air—no oxygen, or anything like that; we simply exist on what is in the submarine. I myself have been 36 hours under water, using the air that was in the boat when it started: I did not come to the surface at all, and I had no oxygen, or anything. Of course that is not usual; you usually come up at night and replenish your air through the conning-tower hatch.

AN OFFICER: I should like to know to what depth the submarine can go before the pressure becomes too great?

COMMANDER THOMSON: That again very much depends. A German submarine went down to 440 feet by mistake—she did not choose to; she suffered no harm at all, and came up all right. E.12 was stuck down in the Dardanelles at 250 feet; for quite a long time (I think is was 20 minutes) she could not come up.

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AN OFFICER: You can go down a good deal further than a hydroplane can see you?

COMMANDER THOMSON: Yes, I am afraid I hold no brief for aeroplanes seeing a submarine under water; they are far more effectual for locating a submarine on the surface; and it is this which makes them so useful. All these hydrophone things, and the various other gadgets we have produced, are of very little use; but the aeroplane does keep a submarine down.

AN OFFICER: The Lecturer said that there was wireless on the submarines; is there any form of submarine telephony, or anything like that, which can be used?

COMMANDER THOMSON: Yes, we have under-water sound-signalling. We can communicate with each other, even now, up to 10 miles under water by a system of sound signals. It is much the same, really, as hydrophones. It is simply that one submarine makes a noise by means of a diaphragm plate, and it is heard 10 miles away. We often make such signals to one another. Then, of course, submerged wireless is coming along, too. It is very much in its infancy at present; but, no doubt, in a year or two, submarines will be fitted with submerged wireless, and submerged telephones, too. It is all in process of development now, of course, but the present system in use is the sound signals.

AN OFFICER: Is there any difficulty in knowing absolutely at what depth you are?

COMMANDER THOMSON: None whatever. We are supplied with a depth gauge. As a matter of fact, the deepest one I have been shipmates with is graduated to 350 feet, but I have never been down to that depth myself. There is no reason why you should not have one graduated to 500 feet if you are expecting to go down to that depth.

AN OFFICER: What is the steepest angle at which a submarine will go down or come up?

COMMANDER THOMSON: You like going down almost horizontally; but sometimes you let in too much water forward, and get an angle on, and you go down. I was in a "J" boat once when we went down at an angle of 15 degrees; it is very unpleasant, because you have to hang on overhead. It is very very nasty, in fact, in a big boat, because you do not come up unless there is a bottom to hit; so you always, if possible, try and go down horizontally. You do not want to get an angle on; you can imagine if you have a very big ship and she is moving at six or seven knots, going down like that she requires some stopping; so, if you can, you try and dive horizontally instead of at an angle. In fact, it is the real trouble we have had lately with big boats. You cannot help boats getting an angle on sometimes; you make a mistake, you let in too much water forward, then you are out of trim, and go down at an angle instead of going down nicely horizontal. A big boat, I say, requires some stopping. Many and many a big boat has been saved by the fact that the bottom is only 150 feet down instead of 1,000 feet. We often hit the bottom in big boats. We are going into the question of controlling the large boats, and we think really we have overcome our difficulties now. We have got a lot of fresh means of controlling boats, which we did not have in the last war.

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SAME SPEAKER: Could you bring her up in any case by forcing the water out, if you found you were going at too steep an angle. Could you, without using your planes at all, come to the surface?

COMMANDER THOMSON: You mean by blowing tanks?

SAME SPEAKER: Yes.

COMMANDER THOMSON: In a small boat is is all right, but in a big boat she has such an enormous momentum. Take a K boat, a 2,500 tonner; if she is going down like that (at an angle) it does not matter how much water you blow—she will come up eventually— but the danger is she goes to such a depth that she gets squashed in, so you always try to avoid having an angle on; in other words, you have to be doubly careful of your trim in big boats.

AN OFFICER: Were there many occasions where a U boat went to the bottom where the crew escaped by getting clear. One hears of men being blown to the surface, and that kind of thing.

COMMANDER THOMSON: Yes. There has never been a case of anybody actually getting clear from a German boat from the bottom, but there has been from our boats. We have had one or two cases where a fellow has been on the bottom for perhaps an hour or two and has come up, but I have never heard of a case from a German submarine. We had an accident with two E boats, they were attacking one another, they both sank and one Stoker Petty Officer came out of one boat after about two hours. The submarine has got water-tight doors inside; it is divided into compartments, so that if one compartment is holed you can still live in the other.

AN OFFICER: During the war, did you have ships as your bases at all or was the geography of the war suitable to your having land bases?

COMMANDER THOMSON: Yes, we always had ships for bases, but they were usually stationed at some convenient port.

AN OFFICER: Supposing we were fighting a self contained country, say America for the sake of argument, with all our commerce coming to us, she being self contained and she had none of her commerce to be destroyed, would you be able to use submarines at all under those circumstances?

COMMANDER THOMPSON: I thing you would have to have a base ship to come back to for your patrolling submarines, but the danger to us, of course, is the ocean going submarine, the big boat. She does not want a base; she can remain at sea for four or five months, and she carries big guns. She will not be so much a torpedo craft as a gun craft. Of course in the olden days the French commerce destroyers did not succeed because after a bit their cruisers and privateers had to clear out of it. Now the submersible commerce destroyers will not clear out; they will simply submerge for a time, come up and pull a long nose at you and submerge again. It is really a very difficult problem, but I think the Admiralty has certainly got it in mind, anyway.

QUESTION: Can you tell me what actually happened to the German commerce submarines which went over to the States and returned. They were eventually captured, were not they?

COMMANDER THOMSON: Which do you mean?

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QUESTION: One or two went over to the States and returned.

COMMANDER THOMSON: The *Deutschland* went over and the *Bremen* started on the voyage to America, but she never got past the North Sea. She was sunk. She hit a mine. But the *Deutschland* is the only one—besides U.53, of course, which went over about 1916—the *Deutschland's* was the only trip that was successful. The *Bremen*, the sister ship of the *Deutschland*, started off, and she never got past the North Sea. So they did not send any more. There is no doubt that a submarine could be used for carrying commerce; it would be quite easy to use them for carrying troops about. We are developing very very fast in submarine construction; it is only a matter of telling your constructor what you want. If you want a submarine to carry 1,000 men somewhere he will build one for you quite easily. You can build a submarine really of any size or dimensions; the only point to remember is that in competition against a surface ship she is bound to be less powerful because she has the power of submersion, and to get that power she has to sacrifice other qualities—surface qualities.

QUESTION: It must be very unpleasant for you fellows to be torpedoed by your own side when you come to the surface. I suppose that is a difficulty which will be got over some day, will not it, although I understand it has not been so far.

COMMANDER THOMSON: It was got over really towards the end of the war, because we had very efficient recognition signals. I would not like to say the number of times I have been fired on by our own craft; luckily they shot very badly; but still it was a very great difficulty in the first three and a half years of the war, but towards the end of the war we had a very efficient system of signalling—quite an efficient one.

QUESTION: If a boat settles down in the mud is there any difficulty in getting it off?

COMMANDER THOMSON: Not the least.

SAME SPEAKER: Was there at one time?

COMMANDER THOMSON: No, take for instance one concrete example. Supposing a K boat settles down in the mud. To get her under water at all you have to let in about 500 tons of water, or 600 tons to be exact; you have got those 600 tons to play about with; if you think you are stuck in the mud you go on blowing water till you have got that 600 tons out, and it will require a very sticky mud to hold on to you then. There is not the least danger of sticking in the mud. The only danger to boats really is over-trimming, letting in too much water, and then not being able to pull yourself up in time before you have reached a depth which crushes you in. That is practically the only danger, as far as the submarine is concerned, and we are rapidly getting over that difficulty now, I think.

QUESTION: When you have occasion to rise to re-charge your batteries and replenish your air, are you prevented from doing that by heavy weather?

COMMANDER THOMSON: No, a submarine can remain on the surface in any weather she likes. You are very often prevented from doing so by enemy craft fighting you under, and then you have to

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simply trust to luck. If your battery is getting very low, all you can do is to go on the bottom and wait there till you think the enemy has gone, and then come up and have a look. I am not talking so much about a K boat, they are all steam driven and have a lot of funnel openings, but the ordinary Diesel engine boat has only the conning tower hatch, and if the enemy comes back she closes that hatch and dives and watches through her periscope until the enemy has departed.

QUESTION: Does bad weather on the surface interfere with the submarine boats?

COMMANDER THOMSON: Well, it does; it depends very much on the depth of water. It is a scientific fact, and I cannot explain it, but, if there is a big sea on top, a boat cannot lie on the bottom if it is less than 120 feet deep. If it is over 120 feet she can lie on the bottom, and lie quite quietly whatever sea there is; but under 120 feet, if it is a very heavy sea, she has to come up off the bottom. Christmas Day, of 1917, I spent at 75 feet rolling 15 degrees each way. So that you see you are affected under water a good deal by the sea on the top. It was too rough to keep a periscope patrol on the surface. You could not do it because the boat kept on breaking surface, so all we could do was to go down to 75 feet and try and listen on the hydrophone; it was a very poor way of patrolling, but we could not have done much in the way of torpedoing, because it was a very bad day; anyway it shows you how our movements are affected by the sea on top.

QUESTION: With these later submarines that have the 12-in. guns, is there any means of loading them under water, or have they to be loaded after you come up?

COMMANDER THOMSON: You have to come up to load.

SAME SPEAKER: It takes a little time to get into action then?

COMMANDER THOMSON: It takes a very short time really. What we like using them for now—it is not a recognised use—but what we fellows who command them like using them for is first of all to fire a torpedo at a ship and damage her with the torpedo, then come up quite close at point blank range, at 600 or 700 yards, with the 12-in. guns already loaded—we come up and fire a round and get down under again. That is what they like doing. There are all sorts of possibilities for the use of a craft like that. You can imagine her being on a coast where she could put 20 shells into a town before you could get your patrol vessels along; but she must come to the surface after the first firing to reload.

THE CHAIRMAN: Ladies and Gentlemen, if no one else wishes to ask a question I have only just to say that I feel confident you will agree I did not exaggerate before the lecture when I said that the subject was about the most interesting you could have, and that we should learn a tremendous lot, and that what Commander Thomson did not know about submarines was not worth knowing. I am sure you thoroughly agree with that now, and therefore you would wish me to thank him most cordially for his kindness in coming here to-night.

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THE GERMAN EMPEROR AND THE BATTLE OF THE MARNE.

BY LIEUT.-COL. H. ROWAN-ROBINSON, C.M.G., D.S.O.

WAS the German Emperor directly responsible for the German defeat at the Battle of the Marne?

This is a question that will certainly be widely discussed by future generations. At present there is no definite proof. One, at least, of the principal actors is dead, and the countless German writers on the war have, for the most part, been officers—a class strongly monarchical and, with all their faults, loyal to their former sovereign. No accusation against the latter has therefore emerged from their published mass of post-bellum literature. Nor indeed during the war were many reproaches levelled against him. A grumble perhaps here and there at interference and an occasional threatened resignation; but that was all. The High Command[1] were indeed severely criticized, for they completely lost control of the situation during the critical moments of the Battle of the Marne; but the complaints were directed against von Moltke, the responsible chief, and no hint has been allowed to escape of any fault emanating from a higher sphere connected with the direction of the battle.

Three reasons may be adduced for the suggestion that interference on the part of the Emperor was the true cause of the defeat of the Germans at the Marne and hence also the cause of their ultimate defeat :—

1. His choice of von Moltke as Chief of the General Staff.
2. His fondness for his possessions in East Prussia.
3. His presence at the battle for Nancy.

Wilhelm II. had a constitutional aversion to strong men. He liked to rule in the State as he ruled in his own household. The most notorious example of this aversion was the dismissal of Bismarck. But even the removal of the strong did not suffice. The Emperor was never really happy till he had got a thoroughly weak person, in Bethman-Hollweg, as his chief Minister.

Now Count von Schlieffen—the man who succeeded to the post, and to a large extent to the mantle, of the great von Moltke, was a man of Bismarckian stamp—an able, hard-headed, hard-working, dominant personality, without a grain of humour or a thought beyond his profession. Under his charge the German General Staff and the German Army reached their highest grade of efficiency. But men of his type, though excellent commanders, are not pleasant to live with, nor do they make ideal subordinates to men inferior to them in intellect, knowledge and force of character. It may be safely inferred

[1] The Emperor was the Titular head of the army and navy and was represented in each service by a Chief of the Staff who was the real executive head of his branch. The head of the army and his staff formed the O.H.L. (or G.H.Q.) and were referred to ordinarily as the High Command.

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from a knowledge of his other qualities, that von Schlieffen was wholly lacking in tact in his dealings with his Imperial master; and that the latter was exceedingly glad to see him go. Although, at the time of his retirement in 1906, von Schlieffen was still full of energy and had the entire confidence of the army, no effort was made to retain him beyond the normal age.

At his departure Wilhelm looked round for a man of docile character; and, much to the general surprise, appointed the younger von Moltke—a nephew of the victor of 1870— as Chief of the Staff. Among the candidates for the post, the Kaiser's nominee appears to have been below the average in merit, knowledge and independence of spirit. In fact, it is hardly too much to say that his main, if not his sole recommendation lay in the possession of a famous name. He was pliant and tactful, with something of a sense of humour. When asked, for instance, what action he would take against the British Expeditionary Force when it landed, he remarked that he would put the lot in the guard-room. An amusing fellow, apparently, with none of the nasty corners of von Schlieffen. With such a man at the head, the Emperor would naturally be able to exercise a much stronger personal influence on the army—an influence more in proportion to the striking military talents of which he believed himself to be the possessor. He was now therefore to be seen more than ever at manœuvres leading flashy and impossible cavalry charges and demanding parade-show at the expense of efficiency.

Now the plan of campaign for a war on two fronts had been drawn up by von Schlieffen with the full concurrence of his collaborators on the Great General Staff. Therein, from the purely military point of view, it is difficult to discover a flaw. On the semi-military and political objections to an advance through Belgium, which was the essence of the plan, judgment is no longer easy, for the reason that the plan was modified by other hands prior to execution. The risk of adding England and Belgium to the list of enemies was fully appreciated, but compensation was to be found in the chance of a smashing victory over France.

Von Schlieffen does not appear to have been a man of wide intelligence, but he had certain simple ideas to which he held very firmly: one was the value of envelopment, and another the need of strength at the decisive point. Briefly, a great right wing containing the cream of the German army was to sweep through Belgium and, pivoting about Thionville, to envelop the French and their allies. Alsace was to be abandoned and the left wing refused. The latter, in the event of a serious French offensive in that quarter, was to fall back on the fortified line Metz-Strasburg. Any troops that could be spared from it after the opening moves were to be sent to strengthen the right, or decisive wing.

It was a great and simple idea. But Moltke tampered with it. Possibly he had not the strength of mind to abandon territory without a blow; so he garrisoned Alsace. He also strengthened the left somewhat and in 1910 cancelled the arrangements for the eventual despatch of the 7th Army from left to right. These changes, which altered the plan materially for the worse must, of course, have had the approval of

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the Emperor; but how far, if at all, they were made at his suggestion is impossible to say. It seems a fair inference, however, that, as the General Staff thoroughly approved of the Schlieffen plan, Moltke would not have dared to alter it on his own responsibility. He had never wished to be chief of the Staff. He had never prepared himself for the post. He was a weak and rather amiable man without the knowledge to initiate or the character to execute an important reform. The life-history of the Emperor, on the other hand, is that of a man who regards himself as divinely inspired and therefore able to dispense with the intimate knowledge needed for the correction of a plan upon which hung such tremendous issues.

We now come to the next point. The General Staff, felt confident, even with the modified plan, that they possessed all the elements required for success, except numbers. They were sure the Russians would be slow and that they would have time, before their intervention, to beat the French, given a sufficiency of men. Late in 1912, Ludendorff, then a Major, had put forward an able memorandum in which he made a demand for three extra Army Corps. He expressed a strong opinion that, without this necessary addition, the operations on the two fronts could not be successfully executed. His request was refused. It is mentioned to show the great importance that was attached to the presence or absence of a few corps owing to the even matching of the opponents in the Western theatre.

The Western operations succeeded at first almost beyond expectations; but from the Eastern front disquieting reports were received. The Russians who, prior to the war, had spent large sums on expediting and practising their mobilisation, deployed on the East Prussian frontier sooner than was anticipated and gained a few initial successes.

In the face of this emergency the German Commander in the East and his principal staff officers lost their nerve. They prepared to retire behind the Vistula; and their discouraging statements spread alarm and despondency among the troops. Hoffmann, then a Major, alone appears to have kept his head. He reported his Commander and Staff as incapable, and asked for their replacement. He then began to work out, with the existing conditions, the war-game the German Staff had so often played in peace days—that of a weak force operating on interior lines against an enemy to the East (Rennenkampf with the Niemen Army) and an enemy to the South East (Samsonov with the army of the Narev). His calculations showed the situation to be dangerous but not hopeless.

The High Command acted promptly, removed the offending Commander and ordered Hoffmann to take charge temporarily pending the arrival of Hindenburg and Ludendorff who had been appointed respectively Commander and Chief of the Staff in East Prussia. Had they stopped there—and to have done so would have been quite in accordance with the Schlieffen tradition—all would have been well. Tannenberg was won and East Prussia saved before any reinforcements arrived from the West.

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Unfortunately for Germany, two Corps belonging to von Kluck's victorious right wing—that is to say a body equal to the British Expeditionary Force after reinforcement by the 4th Division—were withdrawn and railed to the East. It is impossible to estimate accurately the effect of this action. Manoury was certainly near defeat on the 8th and 9th September. Had von Kluck been able to leave one Corps to support von Marwitz opposite the British and used the other against Manoury, he might well have won the battle of the Ourq, then overwhelmed the British and enveloped Franchet d'Esperey, to the ruin of the whole Allied Army. Or, and more probably, the two corps might have been effective earlier, contributed to the destruction of the British and prevented the formation of the French 6th Army.

It has been shown that the danger in East Prussia was greater than had been expected. But the Russians, though they had started quickly, were operating, otherwise, exactly as had been anticipated. They were still far from the Vistula and Hoffman did not regard the situation as beyond hope. The German Staff had indeed prior to the war considered a possible Russian advance to the Vistula and had hoped to be able to counter it by a skilful use of that great river and of the fortress of Thorn and Posen.

Now what was the power that overruled the long-considered determination to risk all on a decisive victory over France and only to turn against Russia when France was beaten?

In East Prussia lies the old Mark of Brandenburg, a rich and fertile province and the ancient home of the Hohenzollerns.

In the circumstances it may well be suggested :—

Firstly, that it was strongly to the interest of the Hohenzollerns to take immediate steps to save East Prussia.

Secondly, that, as the situation did not differ much from what had been predicted in peace-appreciations of the probable course of events on the hundreds of occasions the Great War had been played in war games and staff tours; that, as the General Staff had thoroughly assimilated the plan that France must first be crushed even at the risk of an effective Russian advance, it is improbable that the despatch eastwards of the two corps was either initiated or supported by them. It has, further, already been pointed out that Moltke was not the man to take independent action unaided in opposition to technical opinion. It seems, therefore, possible that the Emperor, either wishing to spare the inhabitants of the invaded provinces or anxious for the safety of the family possessions, exercised pressure upon his old aide-de-camp and caused him to strengthen the defenders of East Prussia at the expense of the striking wing of an army on the verge perhaps of the greatest victory in the history of the world.

Finally, there is to be considered the presence of the Emperor at the Battle for Nancy.

It has been stated above that the Schlieffen plan consisted mainly in an enveloping attack with a powerful right wing and the continued reinforcement of that wing by any other troops that could be spared from elsewhere. The attack of the frontier fortresses from Belfort to Verdun or of the *trouée de Charmes*— a gap expressly left by the

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French in the fortified line to encourage the enemy to attack there—formed no part of the scheme. Someone connected with the general direction of the war seems, however, to have had his judgment disturbed by the decisive victory gained about Saarburg, where the French 1st and 2nd Armies were completely defeated. Adhering to the Schlieffen plan the natural result of this success should have been the despatch of strong reinforcements to the right wing. Instead, Castelnau is pursued by the whole force of the 6th and 7th Armies.

And now the man "in shining armour" rushes to the spot, to be present at the decisive point where, the guardian-line of fortresses having been pierced, German legions can pour resistlessly on to Paris, connecting there with the victors of Belgium.

The whole idea is so essentially unsound that it is difficult to believe it could have occurred to a professional soldier. The French were to be fought at a distance of two hundred miles from the capital, on ground selected by them with the utmost care in peace time, when, about half that distance from the capital, a force was already well on its way, working on lines of operations previously selected, to envelop the French left, cut it off from Paris and perhaps hurl it backwards on to the line of fortresses.

Von Kuhl[1] quotes the official opinion of the General Staff on this point prior to the war: "It is an extraordinarily strong sector. The Moselle below Epinal is a formidable river 40 to 50 yards wide. Alongside it runs a deep canal, and the two together form a very difficult obstacle. The valley is one to two kilometres wide and, in places is absolutely flat and devoid of cover. The ground in the left-bank is more favourable to the defender than is the right bank to the attacker. Both of the defenders flanks are supported by great fortresses. The assailant is limited to frontal attacks—"And he also quotes a similar opinion in the general question of an attack on the line Belfort—Toul." The effect of the fortress added to the natural strength of the unfortified sector will compel the attacker to pass from a war of movement to position warfare. The French covered by this strong line may hope in such a case to be able to transfer troops to one point or another so as to pass to the attack with superior forces.

The last sentence was truly prophetic. After expressing such opinions is it likely the General Staff would have advised the advance of the left wing?

Actually too, the oft repeated war games had predicted here as elsewhere the course of the opening events. The French onset in the Vosges was expected; it had met with preliminary successes. It had then been countered much on the lines laid down; and the defeat was so decisive that Moltke need certainly have had no further anxiety regarding his left wing. He had, indeed, been quickly and satisfactorily relieved of the consequences of having tampered with Schlieffen's ideas. In the circumstances, a return to the original plan would naturally have been expected and urged by O.H.L., and Moltke, but for exterior influence, would certainly have yielded. Again it is difficult to avoid the conclusion that the evil genius of Germany furnished the inspiration to contrary action. His unstable character, unbalanced by the first brilliant victory, the desire of

[1] Der deutsche General Stab p. 57.

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intermeddling, of having his finger in the largest pie, his delight in running after someone who was running away—all seemed to fit a personage who for thirty years had persistently revealed his qualities to the world.

Repeated assaults inspired by the Emperor and delivered regardless of cost, are made upon the impregnable positions in front of Nancy. Castelnau repels them with such ease that he is able at the same time to despatch division after division to assist Joffre in building up new reserves with which victory may be won elsewhere. If Wilhelm was the culprit he may be judged to have failed badly when quoted the Napoleonic dictum: "La première qualité d'un général en chef est d'avoir une tête froide qui reçoive des impressions justes des objets, qui n'échauffe jamais, qui ne se laisse pas éblouir, enivrer par les bonnes et les mauvaises nouvelles."

The battle of the Marne will always be regarded as one of the most curious episodes in history. The Germans, by basing their plan on a breach of faith, spring a huge surprise upon their enemies. Their initial successes equal their wildest aspirations. Suddenly they make two mistakes: von Kluck in the midst of his victorious career is weakened by two corps, and the refused left is turned into a striking force. Both actions are wholly contrary to the original design of the Great General Staff. It is possible to regard the first as the effect on a weak man like Moltke of the outcry of the inhabitants of the invaded districts; but for the second no excuse can be preferred. The cumulative result is the defeat of the greatest blow ever struck at civilisation.

On the other hand, the French initial offensive, limited in its scope by an honourable regard for the pledged word, is thrown back both in the Vosges and the Ardennes with heavy losses. The left wing fares no better; and the whole army appears on the verge of being overwhelmed in irremediable disaster. But where the Germans in the midst of their success have cast to the winds the basic idea of their strategy, the great-hearted Joffre, through defeat after defeat, unshakeably holds to the French doctrine and patiently builds up the reserve with which he achieves ultimate victory.

The French recovery was due in the main to the quick advantage taken of the enemy's mistakes; but the complete breakdown of the German strategy is much less easy of explanation. To give the devil his due, the German professional soldier had a thorough knowledge of the art of war. A number of fine leaders and profound thinkers—Scharnhorst, Clausewitz, Roon, Moltke and Schlieffen—had furnished the directing force of the army; and a succession of victories in '64, '66 and '70 had confirmed belief in their principles of training. The result was a General Staff thoroughly imbued with teaching which had continually proved its efficacy, a body so solidly constituted and so strong in faith, that the mischance of possessing a weak chief at the critical moment would probably not have adversely affected their action to any serious extent unless other influences were at work.

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SAVAGE WARFARE AND THE DEVELOPMENT OF MODERN WEAPONS.

A reply to Capt. Stevenson's Article in the R.A. Journal for January, 1921.

BY CAPT. R. HILTON, M.C., D.F.C., R.G.A.

IT was only to be expected that certain remarks about the value of Mountain Artillery, made by the writer in the Journal for October 1920, should have aroused some feeling among officers who have specialized in that branch. When one has spent any considerable time in some branch or arm of the service it is naturally extremely distasteful to hear the slightest suggestion that such a branch may be outgrowing its usefulness, or that part of its work may be more economically done by other means.

Capt. Stevenson gives voice to this feeling in the January number, and a tinge of pardonable bitterness can therefore be detected in his article. Probably the knights of the Middle Ages were intensely annoyed if anyone dared to suggest that the noisy and erratic "bombards" used at Crécy would end by relegating their beautiful armour to museums. Officers of the Prussian army a year or so before Jéna would have been equally upset had anyone hinted that their parade-ground tactics were not all that infantry tactics should be.

Excellent though such a spirit may be, it may easily lead the enthusiastic specialist towards narrow-mindedness. That is to say he may only visualize that form of warfare in which his pet weapon plays an important part. For instance Capt. Stevenson complains that machine guns "would be of little use for destroying frontier towers or sangars." But why destroy them at all when the enemy can be subdued much more effectively by smashing his moral by means of aircraft?

He quotes the failure of aerial bombing to finish the operations on the North West Frontier. A study of the technical and climatic difficulties to be overcome by the units employed there will show the reasons for this lack of complete success. No great development of weapons or tactics yet evolved has ever "cut much ice" the first time it was tried; and it must be remembered that it was the first time it was tried in a theatre of war of this kind. The experience gained will enable those difficulties to be overcome before long.

Let us now consider another recent example of savage warfare—the campaign against the Mullah in Somaliland. This war had been going on intermittently for about twenty years at heavy expense to ourselves, and generally speaking without much success. In fact it

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had resulted in considerable loss of British prestige. By the use of a single squadron of bombing machines the Mullah's power was smashed within two months of the commencement of operations, and he himself with less than a dozen followers was a fugitive discredited by all the tribes. His power, which was based mainly on his own personal prestige, has received a more severe blow than could have been given by dozens of punitive expeditions.

In view of Capt. Stevenson's remarks about "frontier towers and sangars" it may be noted that the Mullah possessed several forts of extraordinary strength, upon which mountain guns or even 18-pdrs. would have had little effect. His men were driven out of these forts by aerial bombing alone.

To return for a moment to the North West Frontier operations—could anyone deny that a similar result might have been achieved by aircraft there, if the R.A.F. had had a few years experience of the peculiar difficulties due to local conditions?

Given this necessary experience, it is an open question whether the operations would not have been brought to a successful conclusion earlier, if the money and resources actually spent on ground troops had been spent on aircraft and their accessories.

After all, that is the only fair way to compare the two weapons. The British Empire is concerned in many parts of the world in keeping uncivilized and barbarous races in order. The result of this state of affairs is that punitive expeditions against such peoples assume a greater importance for our army than for that of most European nations. We have recently increased the probable amount of this sort of work very considerably, and so it is extremely important for us to make use of the most economical means at our disposal, even though it may render obsolete a very pleasant branch of the army.

The present situation is that for many years the old type of punitive warfare, in which mountain guns play an important part, has had the opportunity of proving itself an effective means of suppressing turbulent races in undeveloped country all over the world. *It has utterly failed to do so.* Not only with ourselves but with most other nations in similar circumstances, cases could be quoted of some turbulent leader or tribe being a constant "thorn in the flesh," necessitating numerous expensive expeditions, none of which ever do any permanent good.

The great difficulty is almost always the country, much more than the fighting power of the enemy. If the column is weak the enemy wipes it out: if it is too strong for that it is long and unwieldy. In this case the enemy easily avoids any real collisions, in which he might get a salutary punishment, and contents himself with sniping and harassing the march, and with cutting up small parties whenever possible. Consequently the expeditions reach their objectives without forcing the enemy to accept anything in the nature of a decisive battle. No confiscation of property or burning of villages can have the same effect in stopping further outbreaks in the future. The only really satisfactory remedy is to imbue the enemy with a sense of helplessness against civilized arms. Punitive expeditions of all arms can never give him this feeling. Aircraft have already done so, and will do so

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still more in the future. F.S. Regs. (provisional) 1920 seem to be of the same opinion.[1]

If Capt. Stevenson had read the article to which he takes exception a little more carefully than he apparently has done, he would see that nothing more has been claimed for aircraft than the results they have actually achieved in Somaliland. It is distinctly emphasized that in many cases the enemy may adopt a strictly guerrilla type of warfare, in which aerial bombing would be useless. In such circumstances it was suggested that machine guns would be more useful than mountain guns, and would need far less transport, thus allowing columns to be more compact and mobile, which is exactly what is required.

Briefly the theory propounded is that aircraft will deal with any enemy who fights in such a way as to provide *tangible resistance* and therefore tangible bombing objectives.

The only other possible kind of warfare would be something similar to the present Sinn Fein operations in Ireland. The relative value of mountain guns, with their comparatively unwieldy transport columns, and of machine guns, with their comparatively small amount of transport, against an intangible enemy of this kind can hardly be matter for doubt.

If the whole question is considered from this point of view Capt. Stevenson's remark about the opinions of Pathans on the subject is rather beside the point, which is very fortunate as I have not had much opportunity so far of discussing the matter with them, and finding out whether they disagree with me as much as he says they do.

But if the moral effect of mountain artillery on tribesmen is as great as all that, how is it that they are still as turbulent and unruly as they have always been ever since we first came into contact with them? The proof of the pudding is in the eating.

The disappearance of mountain artillery would be regrettable for very many reasons—traditions, esprit de corps, sport, etc. But from the severely practical point of view of efficiency, economy, and utility, one can well apply to it the words of Balaclava "C'est magnifique mais ce n'est pas la guerre."

[1] "The moral and material effect of a vigorous aerial offensive will often render further military operations unnecessary." (Vide F.S.R. (provisional) 1920. Vol. II., Sec. 164, para. 3).

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A REPLY TO ARTILLERY AND AIRCRAFT.

Appearing in the March number.

BY CAPTAIN A. H. MORTON, M.C., R.F.A. (LATE R.A.F.)

IT is universally agreed that mutual confidence and a thorough knowledge of each others duties are the essentials necessary for efficient co-operation between artillery and aircraft.

It was not realised till late in the war that the Gunner Officer is far more suitable for Artillery observation from the air, than officers from any other branches of the Service, and that they become efficient in a far shorter time.

Organization.

The ideal obviously would be for the Battery Officer to control the fire of his battery from the air, as he does from an O.P., but this unfortunately is impossible under present conditions.

The idea of establishing landing grounds at brigade or group headquarters to enable battery officers to be "taken up" to observe the fire of their own batteries, is quite impossible as long as aircraft require such comparatively large expanses of unbroken ground on which to land, and are so difficult to conceal. In the average country of Western Europe, it would be impossible to find suitable landing grounds in 75% of the cases; and in position warfare shell holes and rear trench system would increase this to 99%.

Even if a machine could land, it would very shortly be located and shelled by the enemy's artillery. If landing grounds were selected further back, say at Divisional Headquarters, the time taken by Battery Officers reaching them would be prohibitive.

The number of machines required (at least one squadron per division as suggested) could not be provided in the present state of Military Finance: as of course the existing organization of Corps Squadrons would have to be maintained in addition to carry out infantry work, artillery patrols, photography, etc.

The whole scheme would be very uneconomical of man and machine power, as under the present system though a pilot may go up with one main object in view, that of ranging a particular battery, he has several other tasks to carry out, such as taking photographs of the target, taking on N.F. or LL shoots and procuring information for I Branch: all of which require more training than could be given to a battery officer.

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Also the Intelligence branch of artillery squadrons would be entirely disorganized; it is very essential that all pilots should be interviewed before and after every flight by the Squadron Intelligence and Artillery officers, in order that the highly organized system of collection and dissemination of information may be used to the full. This would be impossible with numerous scattered landing grounds.

Again, the Art of observing and correcting shell fire from an aeroplane, is not acquired in a few short flights, and even when acquired, continuous practice is necessary to maintain a state of efficiency. A battery officer would not obtain nearly sufficient practice, carrying out perhaps one or two shoots a week, whereas an R.A.F. Artillery Pilot will probably do three or four a day.

Communications.

Wireless telephony is by no means an ideal form of communication between batteries and aeroplanes. The present code system is perfectly clear and very concise, and if the battery and pilot know their jobs thoroughly, it should not admit of any misunderstanding. It is almost certain that verbal conversations would lengthen the time spent in communication and would also increase the number of mistakes in transmission. There is already on the ground a tendency to codify messages between O.P. and Battery. Communication from battery to aeroplane by wireless telegraphy would of course reduce the number of "failures" due to misunderstandings, but this would entail batteries carrying transmitting sets, and fuel for them, either in the form of petrol or accumulators, a further addition to the already overburdened battery transport.

But Wireless Telephonic communication between the C.B.S.O. and Aeroplanes, is quite a different matter, and is much to be desired, especially in moving warfare. This would also be available then in the case of "failures", by the C.W.S.

But there is a further point of the utmost importance which bars the Battery officer from doing his own observation, in that it is essential that the Pilot should do the observing. It has been definitely proved that with the observer doing the shoot, the time taken is very much greater owing to the difficulty that he has in directing the Pilot to manœuvre the machine into the right position at the right moment.

The alternatives to the system proposed are :—

1. To give R.A.F. Pilots courses in Artillery work, or

2. To second Gunner Officers to the R.A.F. in peace time from two to four years, always keeping a sufficient number with the R.A.F. to man the Artillery Flights of Corps Squadrons in War. There are of course objections to both these, but the latter seems to promise the greater success.

To obtain the personal acquaintance of Batteries and their observing Pilots, it is essential that the pilots of the Artillery Squadron should train in peace time with the batteries of the Divisions and Corps with which they will work on mobilization.

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There seems no reason why Brigades at their annual Practice should not be accompanied by the Pilots of the Artillery Squadron attached to the Division or Corps. The machines being provided by a Depôt Squadron.

Method giving Corrections.

The old clock code system worked and still works very well. Any system involving the observing of pluses and minuses must be ruled out immediately as being only applicable to Position Warfare, where the position of our Batteries is known. Even in Position Warfare, this system would eliminate the use of the Impromptu Zone Call Shoot. It is very undesirable to introduce any system which is not applicable to all types of warfare and every type of shoot.

Technical considerations in giving Correction from Pilots point of view.

As far as the ease and accuracy of the actual estimation of corrections is concerned, the clock code still comes first.

For any shots which are correct for either Line or Range the estimation under the plus and minus system is of the same order as that when using the clock code system, i.e., the estimation of the distance between two material points on the ground. (See Fig. 1.)

If a round falls at S, correct for range, but "off" for line, to give a correction in either system, the distance S T has to be estimated.

But if a round falls at S^1, in the clock code system it is still only necessary to estimate the distance S^1 T, between two definite points, but in the plus and minus system, it is necessary to estimate the distances S^1 H and S^1 P perpendiculars from S^1 to B T produced and a line at right angles to B T through T, respectively; H and P being imaginary points. The difficulty in this case being much greater.

The converting of the line corrections from yards to degrees is bound to make for slowness.

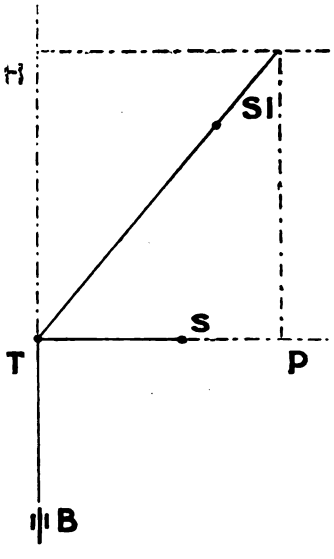

FIG. 1.

Giving the line by Compass Bearing from Aeroplane.

It is no easy matter in an aeroplane to place oneself accurately over a point on a line on the ground joining two other points; and

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with a strong cross wind blowing it would be quite impossible to take the bearing of the line with the compass, with even approximate accuracy, as will be seen by reference to fig. 2.

The circle with centre C represents the Aeroplane compass and bearing of line of flight through the air is read under pointer R.

With a cross wind blowing as indicated, in order to make machine fly from B to T it will be necessary to fly at an unknown angle A C T. The angle now measured by the compass is the angle N C R. The angle required for line of fire is the angle N C T which cannot be estimated with any accuracy.

If the machine were pointed in the line B T, it would be swept off the line by the wind, before the bearing could be taken.

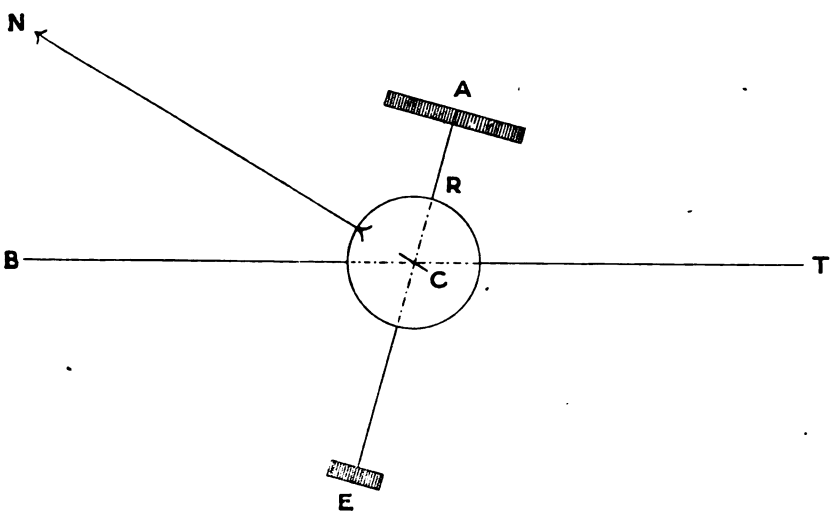

FIG. 2.

Finding the Range on the Bomb sight principle.

This involves the same inaccuracies as experienced in Bomb dropping, that is the great difficulty in flying level in a straight line for any length of time. In bomb dropping the average period for which it is necessary to do this is probably about 30 seconds, while for range finding it would be at least 2 minutes. Also the velocity of the wind as obtained from the Meteor report is not sufficiently accurate and is constantly varying.

But another factor not to be disregarded is the target which this range finding operation would afford to anti-aircraft gunners. An aeroplane flying in a stright line at constant speed and height, offers the best target conceivable to A.A. gunners, as these are assumptions

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on which all A.A. gunnery is based, and as practically no other A.A. target ever fulfills these conditions, all the efforts of the enemy A.A. gunners would be concentrated on these Range finding flights, and with a very good chance of success.

In conclusion it may be pointed out that the conditions obtaining in an aeroplane all militate against the possibility of being able to conduct a shoot in the same way as would be done from an O.P.

The observing officer on the ground does not merely make an isolated correction from the fall of each separate round; each correction takes into consideration all the previous rounds. The whole shoot especially in medium and heavy artillery is carefully recorded on paper and systematic deductions made entailing considerations of 50% zones, etc.

Writing of any sort in an aeroplane, owing to the wind, the cold and thick gloves is very difficult and the careful recording, etc., of a shoot would be practically impossible.

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

The Journal of the United States Artillery—March 1921.

Has an interesting article on Heligoland by Maj.. Donald Armstrong, C.A.C. with 18 full page photographs illustrating the condition of the fortifications in May 1920.

National Service—April 1921.

Our three-years Naval Programme—what it means. Russel B. Moon.

The Field Artillery Journal—Jan.—Feb. 1921.

Artillery Harness and Animal Traction.
French Artillery Doctrine.
Organisation of Command in the Artillery.
French Army (translation).

Belgium.

Bulletin Belge des Sciences Militaires—April, 1921.

I. Operations of the Belgian Army 1914-1918. (Continued).
II. Gas warfare. Dr. Sillevaerts.
III. Tactical security in war. Maj. Requette.
IV. Observation from kite balloons during the war. Capt. de Wandre.
V. On the tactical use of machine guns from the lessons of the war. Cap. Comdt. Jacoby.
VI. Laying out line of fire using a captive balloon as an Aiming Point. Lt. Glenders.
VII. The rôle of the "Sniper". Capt. Stroobant.
VIII. Notes on Foreign Armies.

France.

Revue d'Artillerie—March, 1921.

I. Notes on Artillery Fire. Gén. Dedieu Anglade.
II. Note on the law governing the Resistance of the air to projectiles during flight. Maj. Dufrenois.
III. The "crack" of the bullet—Its effect in a fight. Capt. Loubet.
IV. Fire tactics (continued). Col. Cambuzat.
V. Heavy Artillery on Railway Mountings. (Continued.) Maj. J. Maurin.
VI. On Internal ballistics. Gén. Gossot.
VII. Changes in German Infantry Ammunition during the war (from the German).

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Revue Militaire Générale.—Feb. 1921.

I. The Supreme War Council from its creation. 7th Nov. 1917 to 11th Nov. 1918. Capt. C. Bugnet.
II. Remodelling of Regulations and our War Teaching. (Continued.) Lucius.
III. Transportation by Rail of the American Army in France (1917—1919) (continued). Lt.-Col. Andriot.
IV. Physical Training and Sports. Dr. Maurice Boigey.
V. Foreign Military Activity. Col. Defrasse. (A document concerning the disembarkation of German Troops). According to Gén von Moser the German Command in 1917 reckoned on the possibility of a landing by English Troops not only on the Belgian Coast, but also—either with or without an understanding with Holland—in maritime Flanders and in the island of Walcheren with the object of gaining possession of Antwerp and the mouth of the Scheldt and of taking the German Northern Army in the rear via Ghent and Brussels.
Operations to prevent this were to be prepared by the Military Governor of Antwerp, and a copy of an order from the Imperial Government to Admiral Louran, Commanding Antwerp, dated Nov. 30, 1917, is produced.

Italy.

Rivista di Artiglieria e Genio—Jan. 1921.

Development of the Italian Artillery during the war (1915—1918). Lt.-Col. Barbasetti.

Spain.

Memorial de Artilleria.

Artillery of Accompaniment (continued).

Switzerland.

Revue Militaire Suisse—March, 1921.

I. Strategic Switzerland in the League of Nations. (1). Col. Feyler.
II. The French IX Corps in the battle of the marshes of St. Gond (continued). Col. H. Poudret.
III. The Spirit of the Army and recollections of the Mobilization. Maj. P. de Vallière.
IV. Swiss, Belgian, and French Notes.

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REGIMENTAL LIST. The following Postings have occurred during the period 10th March, to 15th April, 1921.

Postings.—R.H. and R.F.A.

10/3/1921.

Bareham, Lieut. V. A., from D.G.R. & E., Eastern Comd., to II. Res. Bde., R.F.A., Preston.
Clancy, Lieut. R. L., from 17th Bde., R.F.A., Mespot., to 19th Bde., R.F.A., Mespot.
Fane, Lieut. H. W. N., from D.G.R. & E., Eastern Comd., to V. Res. Bde., R.F.A., Woolwich.
Sayer, Lieut. R. H., D.C.M., from Bde. P.T. Supervisor, Catterick, to I. Res. Bde., R.F.A., Newcastle.

11/3/1921.

Downer, Lieut. G. W. F. H., from Mesopotamia, to 4 Depôt R.F.A., Woolwich.
Gee, Lieut. A. J., from Attd. Infantry, Ireland, to 98th Batty. R.F.A., Kilkenny.
Heslop, Lieut. W. T. B., from 17th Bde. R.F.A., Mespot, to 3rd D.A.C., India.
Uniacke, Major C. D. W., O.B.E., from D.G.R. & E. Eastern Comd., to 20th Batty R.F.A., Deepcut.

15/3/1921.

Audland, Lieut. E. G., M.C., from 34th Bde. R.F.A., Brighton, to R.H.A., India (On Appointment).

16/3/1921.

Barstow, Major W. A. T., D.S.O., M.C., from Unposted List (Sick), to Adjt., 69th (W.R.) Bde., R.F.A. (T.F.), Leeds.
Forsyth, Major A. F. J., from Adjt., 55th (Wessex) Bde., R.F.A. (T.F.), Ryde, I of W., to 21st Batty. R.F.A., Fermoy.
Love, Major R. H. A. D., from Adjt., 69th (W.R.) Bde., R.F.A. (T.F.), Leeds, to Adjt. 55th (Wessex) Bde., R.F.A. (T.F.), Ryde, I of W.
Welch, Lieut. S. H., from D.G.R. & E., France, to VI. Res. Bde., R.F.A., Edinburgh.

17/3/1921.

Graham, Major (Bt. Lt.-Col.) Lord D. M., D.S.O., M.C., from G.S.O. 2, Aldershot Command, to 77th Batty., R.F.A., Ewshott.
Joyce, Lieut. W. T. C., from Stationery Services, Constantinople, to VI. Res. Bde. R.F.A.. Edinburgh.
Sutton, Lieut. F. K., M.C., from VI. Res. Bde., R.F.A., Edinburgh, to Attd. 12th Bde. R.F.A., Aldershot.
Vickery, Major (Bt. Lt.-Col.) C. E., C.M.G., D.S.O., from Staff, Egypt, to 68th Batty., R.F.A., Ipswich.

18/3/1921.

Lewer, Major L. W., D.S.O., from Bde. Maj. to Inspr. of R.H. & R.F.A., India, to 145th Batty. R.F.A., Bangalore.

19/3/1921.

Hartland-Mahon, Lt.-Col. M. C. J., D.S.O., from Attd. 14th Bde. R.F.A., Colchester, to I. Res. Bde. R.F.A., Newcastle.

23/3/1921.

Empson, Capt. A., M.C., from 31st Batty. R.F.A., Bulford, to 52nd Batty. R.F.A., Bulford.
Hodgson, Lieut. C. F., from IV. Res. Bde. R.F.A., Woolwich, to 78th Batty. R.F.A., Norwich.
Robinson, Capt. W. H., from 52nd Batty. R.F.A., Bulford, to 18th Bde. R.F.A., Kirkee.

24/3/1921.

Atkins, Lieut. W. H., from R.H. & R.F.A. Records, Woolwich, to 144th Batty. R.F.A., Bulford.
Catherall, Lieut. C. J., from Infantry Records, Exeter, to 24th Batty., R.F.A., Larkhill.
Dannatt, Lieut. A., M.C., M.M., from R.H. & R.F.A. Records, Woolwich, to 77th Batty. R.F.A., Ewshott.
Fergusson, Lieut. J. C., from 25th Bde., R.F.A., Fyzabad, to R.A. Depôt, Deesa, India.

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Postings R.H. & R.F.A.—*Continued.*

Godsal, Lieut. H., from R.H. & R.F.A. Records, Woolwich, to 139th Batty., R.F.A., Deepcut.
Harvie, Lieut. E., from R.H. & R.F.A. Records, Woolwich, to 56th Batty., R.F.A., Brighton.
Holbrook, Lieut. G. A., from R.H. & R.F.A. Records, Woolwich, to 58th Batty., R.F.A., Bulford.
Lane, Lieut. T. W., from R.H. & R.F.A. Records, Woolwich, to 63rd Batty., R.F.A., Bordon.
McKean, Lieut. E. F., from Infantry Records, Exeter, to 28th Batty., R.F.A., Deepcut.
O'Reilly, Lieut. F., D.C.M., from R.H. & R.F.A. Records, Woolwich, to 32nd Batty., R.F.A., Dundalk.
Parker, Lieut. J. A., M.M., from Infantry Record Office, York, to II. Res. Bde., R.F.A., Preston.
Purton, Lieut. G. A., from R.E. Records, Chatham, to 57th Batty., R.F.A., Aldershot.
Wiebkin, Lieut. S. G., from R.H. & R.F.A. Records, Woolwich, to 15th Batty., R.F.A., Coolmoney, Ireland.

29/3/1921.

Atkins, Lieut. W. F., M.C., from 59th Batty., R.F.A., Kirkee, to 18th B.A.C., India.
Chaworth-Musters, Lieut. D., M.C., from 23rd B.A.C., R.F.A., India, to 116th Batty., R.F.A., Jhansi.
Conyers, Capt. C. G. A. J., M.C., from 2nd D.A.C., India, to 86th Batty., R.F.A., Karachi.
Fowler, Lieut. A. S., from 147th Batty., R.F.A., Rhine, to Duty with D.P.M., Cologne.
Hollwey, Capt. John B., from 86th Batty. R.F.A., Karachi, to 2nd D.A.C., India.
Homfray, Lieut. J. M. B., from 147th Batty. R.F.A., Rhine, to duty with D.P.M., Cologne.
Rutherford, Lieut. F. J. B., from 19th Bde., R.F.A., Mespot, to Headquarters, 26th Bde., R.F.A., Jhansi.

30/3/1921.

Evans, Lieut. S. S., from 10th Bde., R.F.A., Mespot, to 5th Batty., R.F.A., Aldershot.
Hewson, Capt. A. G., M.C., from 1st Bde., R.F.A., Kilkenny, to V. Res. Bde., R.F.A., Woolwich.

31/3/1921.

Barkworth, Major J. S., from The Wiltshire Batty., 55th (Wessex) Bde., R.F.A., (T.F.), Swindon, to Adjt., 35th Bde., R.F.A., Bulford.
Colville, Lt.-Col. J. R., D.S.O., III. D.A.C., India, to 18th Bde., R.F.A., Kirkee.
Elliott, Lieut. I., from D.G.R. & E., France, to 130th Batty., R.F.A., Aldershot.
Faviell, Lieut. J. V., from Attd. "L" Batty., R.H.A., Newbridge, to "L" Batty., R.H.A., Newbridge. (On appointment to R.H.A.).
Halliday, Major W. J. F., from D.A.D. of Remounts, Egypt, to R.F.A., India.
Montgomery, Lieut. G. W. C., from Attd. IV. Res. Bde., R.F.A., Woolwich, to 508th Batty., R.F.A., Woolwich.
Preeston, Major (Bt. Lt.-Col.) N. P. R., D.S.O., from 18th Bde., R.F.A., Kirkee, to III. D.A.C., India.
Turner, Capt. W. A. S., from Attd. M.S. Dept., War Office, to Attd. IV. Res. Bde., R.F.A., Woolwich.

2/4/1921.

Pigott, Lieut. H. B., from Artillery School, Quetta, to III. Res. Bde. R.F.A., Hilsea.
Wynne-Williams, Lieut. A. I., M.C., from D.G.R. & E., France, to 138th Batty. R.F.A., Deepcut.

4/4/1921.

Harman, Capt. A. L., D.S.O., M.C., from Remount Depôt, Palestine, to R.A. Depôt, Deesa, India.
Stewart-Cox, Capt. A., from Staff Capt. War Office, to Attd. A.G. 6, War Office—unposted.

5/4/1921.

MacNair, Capt. J. L. P., from Bde. Maj. R.A., 49th (W. Riding) Divn., Leeds, to 77th Batty. R.F.A., Ewshott.

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Postings R.H. & R.F.A.—*Continued.*

6/4/1921.

Eddis, Major L. A., from Bde. Maj. 47th (London) Divn., Chelsea, to Attd. Officer, D.G.T.F., War Office.
McMaster, Major W., M.C., from Attd. H.Q., 5th Divn., Curragh, to Attd. IV. Res. Bde., R.F.A., Woolwich.
Reveley, Lieut. G. M., from A.-D.-C. to G.O.C., 3rd (Lahore) Divn., to Attd. 16th Bde., R.F.A., Palestine.

8/4/1921.

Ettlinger, Lieut. E. S., M.C., from Russian Course, unposted, to 37th Bde., R.F.A., Aldershot.
Welch, Lieut. S. H., M.C., from D.G.R. & E., France, to Attd. IV. Res. Bde., R.F.A., Woolwich.

11/4/1921.

Lambert, Lieut. D. E. R. M., from R.E. Mounted Depôt, Aldershot, to Attd. IV. Res. Bde., R.F.A., Woolwich.
Wray, Major H. C., D.S.O., from B.M., 46th (North Mid.) Divn., Derby, to 20th Batty. R.F.A., Deepcut.

12/4/1921.

Napier, Capt. A. F. S., from Advanced Class, unposted, to Instructor in Ammn. Artillery College, Graded C.C. 1/5/21.
Scroggie, Lieut. J. R. O'D., from 65th Batty. R.F.A., Rhine, to Rhine Army Ammn. Column.
Watson, Capt. W. D., O.B.E., M.C., from Advanced Class, unposted, to Instructor in Carriages, Artillery College, Graded Class C.C. 1/5/1921.
Woods, Capt. E. A., M.C., from Advanced Class, unposted, to Instructor in Guns, Artillery College, Graded Class C.C. 1/5/1921.

13/4/1921.

McCombie, Lieut. H. H., from D.G.R. & E., Scottish Command, to Attd. Head quarters, Irish Command.

15/4/1921.

Cottrell, Capt. A. F. B., D.S.O., from 21st Batty. R.F.A., Fermoy, to Adjt., 72nd (Northumbrian) Bde., R.F.A. (T.F.), Newcastle.
Kirkland, Major T., D.S.O., from Adjt., IV. Res. Bde., R.F.A., Woolwich, to Command, 65th (London) R.F.A. (T.F.), Fulham.
Marryat, Major R., D.S.O., from 64th (London) Bde., R.F.A. (T.F.), Fulham, to 30th Bde., R.F.A., Kildare.
Williamson, Major H. N. H., D.S.O., M.C., from Adjt., 72nd (Northumbrian) Bde., R.F.A. (T.F.), Newcastle, to Attd. 1st Res. Bde., R.F.A., Newcastle.

Cancellation of Postings.

Audland, Lieut. E. G., M.C., posting to R.H.A., India, dated 15/3/21 is cancelled.
Crofton, Lieut. R. C. M., M.C., posting to R.H.A., India, dated 7/3/21 is cancelled.
Eddis, Major L. A., posting to Attd. IV. Res. R.F.A., dated 3/3/21 is cancelled.
McCombie, Lieut. H. H., posting to 53rd Bty. R.F.A., dated 23/2/21 is cancelled.
McKean, Lieut. E. F., posting to 28th Batty. R.F.A., dated 24/3/21. Now placed on unposted list.
Welch, Lt. S. H., M.C., posting to VI. Res. Bde., R.F.A., dated 16/3/21 is cancelled

Unit of undermentioned now as stated.

Audland, Lieut. E. G., "C" Batty., R.H.A., Meerut.
Preeston, Major (Bt. Lt.-Col.) N. P. R., D.S.O., Ref, W.O. letter, dated 1/3/21, 18th Bde., R.F.A., Kirkee.
Winslow, Lieut. L. C., Ref. W.O. letter, dated 28/2/21, "D" Batty., R.H.A., Lucknow.

Death.

Griffin, Major P. G., D.S.O., 16th Bde. R.F.A., Palestine, died suddenly from heart failure. 26/3/21.

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Postings R.H. & R.F.A.—*Continued.*

Staff Appointments, Retirements, etc.

Archer, Major H., D.S.O., from unposted, to B.M., R.A., 51st Div. (T.F.) 22/3/21.
Bell, Lieut. H. T., from unposted, to Ord. Officer, 4th Class. 21/2/21.
Brown, Lieut. K. H., from R.A.F., to H.P. List. A.O., 291/20. 3/3/21.
Brown, 2nd Lieut. A. D. D., from 34th Bde., R.F.A., to Resigned. 12/3/21.
Carson, 2nd Lieut. T., M.C., from G.H.Q., Rhine, to Attd. R.A.O.C., Cologne. 11/3/21.
Cowan, Major W. McC. C., from Staff, War Office, to B.M., R.A., 49th W.R. Divn. (T.F.) 16/3/21.
Churchley, Lieut. J., M.C., from Irish Command, to Retired. 24/3/21.
Cameron, Major C. A., C.B.E., D.S.O., from unposted, to Special Employment. 29/1/20.
Caldwell, Capt. K. F. T., to A.-D.-C., Governor, East Africa. 30/12/19.
Campbell-Johnston, Lieut. C. B. C., from unposted, to Class H.H., Black Sea. 8/1/21.
Cook, Lieut. M. E., M.C., from Attd., R.A.O.C., to Asst. Town Major, Cologne. 18/5/20.
D'Arcy, Capt. J. C., M.C., from 16th Bde., R.F.A., to Staff Capt. R.A., Egypt. 16/3/21.
Dick, Lt. J. D.. H., from unposted, to Intelligence Officer, Black Sea. 19/11/20.
Emberson, Lieut. A. W., from Tanks, Egypt, to Unposted, Home. 16/3/21.
Forbes, Major Hon. D. A., D.S.O., M.V.O., from Unposted, to Retired. 18/3/21.
Fowler, Lieut. A. S., M.C., from 3rd Bde. Ammn. Col., to D.P.M., Cologne. 28/2/21.
Griffiths, Lieut. R. F., from Irish Command, to Retired. 18/3/21.
Harriss, Lieut. F. A., from I. Res. Bde., R.F.A., to Retired with Gratuity. 12/3/21.
Homfray, Lieut. J. M. B., M.C., from 3rd Bde., R.F.A., to D.P.M., Cologne. 28/2/21.
Hume, Lieut. D. V., from A.-D.-C., to Inter Allied Comm., Austria. 31/3/21.
Holdridge, Lieut. A. V., from Attd. R.A.O.C., to Colonial Employ., Palestine. 1/7/20.
Lankester, Capt. F. R. F., M.C., from Attd. R.A.O.C., to Town Major's Dept., Cologne. 16/6/20.
Longmore, Major (Bt. Lt.-Col.) C.M., D.S.O., from Adjt., 35th Bde., to B.M., Nth. Mid. Divn. (T.F.)
Luard, Lieut. R. B., from Attd. R.A.F., to Resigned. 31/3/21.
Loader, Lieut. W. R., M.C., from Unposted, to Prov. Branch, Rhine.
Mousley-Lonergan, Lieut. E. J. H., from 28th Bde., R.F.A., to Resigned. 18/3/21.
McCauley, Lieut. W. C., M.C., from Unposted, to Ord. Officer, 4th Class. 21/2/21.
Rome, Major R. C., M.C., from Brigade Major (T.F.), to Retired. 14/3/21.
Sworder, Lieut. W., from Prov. Duties, Rhine, to W.A.F.F. 9/2/21.
Steward, Lieut. (temp. Capt.) M. E. C., from Unposted, to Class B.B., Mespot. 3/8/20.
Stillman, Capt. R. C. B., to Tank Corps. 31/1/21.
Smith-Pearse, Lieut. T. L. H., from 32nd Bde., R.F.A., to Resigned. 31/3/21.
Sawyer, Lieut. F. G., from 31st Bde., R.F.A., to Adjt. & Qr.-Mr. Bere Island. 22/1/21.
Twyford, Lieut. A., M.C., from R.E. Mtd. Depôt, to Retired. 23/3/21.
Vining, Capt. P. L., from A.-D.-C., to Staff Capt., Rhine. 21/1/21.
Cave-Bigley, Lieut. J., from Unposted, to Censor Officer, Curragh. 31/3/21
Monckton, Lieut. T. C. C., from Cipher Officer, to Special Service, Mespot. 27/1/21.
Burgess, Lieut. G. H., from Cipher Officer, Irish Command, to Cipher Officer, Rhine. 23/3/21.
Rymer-Jones, Lieut. J. M., M.C., from Attd. Irish Comd., to Cipher Officer, Rhine. 23/3/21.
Cuthbert, Lieut. C. R., M.C., from Lieutenant, 1/5/18, to 18/12/17 Seniority, 26/10/17. *L.G.*, 31/3/21.
Twidale, Lt.-Col. W. C. E., C.M.G., D.S.O., from 30th Bde. R.F.A., Kildare, to Retired. 1/4/21.
Savile, Major L. W., D.S.O., from Promoted Lt.-Col., to 2nd D.A.C. 1/4/21.
Cottrell, Major (Bt. Lt.-Col.) R.F., D.S.O., from Asst. Controller, Surplus Stores, to unposted. 1/4/21.
Power, Capt. K. W., from Unposted, to Resigned. 2/4/21.
Crawford, Lieut. C. W., from Unposted, to Retired Pay. 2/4/21.
Kelly, Lieut. S. J., from 9th Bde. R.F.A., Deepcut, to Retired with a gratuity. 2/4/21.
Down, Lieut. N. C. H., from 35th Bde. R.F.A., Bulford, to Cipher Officer, Tank Corps. 5/4/21.
Deshon, Lt.-Col. F. G. T., from 18th Bde. R.F.A., Kirkee, to Half-pay. 6/4/21.

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Postings R.H. & R.F.A.—*Continued.*

Staff Appointments—continued.

Elliot, Lieut. R. N., from 26th Bde. R.F.A., Jhansi, to Resigned to R. of O. 7/4/21.
Lodge, Capt. H. R., M.C., from 18th Bde. R.F.A., Kirkee, to Asst. Superintendent of Experiments. 8/4/21.
Atkinson, Lieut. T. D., from Artillery School, to Retires with Gratuity. 12/4/21.
Crofton, Lieut. R. C. M., from 8th Bde. R.F.A., Deepcut, to Resigned. 15/4/21.
Harvey, Lieut. J. B., from Staff, to Retired. 15/4/21.
Findlay, Lieut. V. A. C., from Unposted, to Resigned. 16/4/21.
Russell, Lt. D. G., M.C., from 37th Bde. R.F.A., Aldershot, to Retired. 16/4/21.
Stockley, Lieut. R. M., M.C., from 4th Bde. R.H.A., Newbridge, to Resigned. 16/4/21.
Kempster, Lieut. temp. Capt. B., from Unposted, to Asst. Mil. Landing Officer, Constantinople. 29/4/20.
Mappledoram, Lieut. R., from 26th Bde. R.F.A., Jhansi, to Equitation School, Ambala. 7/8/20.
Waddington, Lieut. E., from 3rd Bde. R.F.A., Rhine, to Transportation Service, Rhine. 14/3/21.
Barton, Lieut. J. H., from 3rd Bde. R.F.A., Rhine, to Trans. Branch, Rhine. 15/3/21.
Kehoe, Lieut. T. W., from 3rd Bde. R.F.A., Rhine, to Rhine Mil. Water Police. 21/3/21.

Postings.—Royal Garrison Artillery.

11/3/1921.

Chimes, Lieut. W. E. G., from R.G.A. Records, Dover, to North Irish C.D., Londonderry.
Crane, Capt. R., from R.G.A. Records, Dover, to "P" Coast Batty., Milford Haven.
Ede, Lieut. A. J., from R.G.A. Records, Dover, to "N" Coast Batty., Harwich.
Hutley, Capt. H., from R.G.A. Records, Dover, to H.Q. & D.E. Clyde & North Scottish.
Laurie, Lieut. C. J., M.C., from R.G.A. Records, Dover, to "C" Coast Batty., Gullane.
Stearn, Lieut. G. F., from R.G.A. Records, Dover, to "P" Coast Batty., Milford Haven.
Wenman, Capt. S. S., M.C., from R.G.A. Records, Dover, to H.Q. & D.E., Portsmouth and Portland.

12/3/1921.

Kirkpatrick, Major C. D., M.C., from Headquarters, Irish Comd., to Mesopotamia.

15/3/1921.

Bridgeland, Lieut. P., from D.G.R. & E., France, to "N" Coast Batty., Harwich.
Rathborne, Lieut. I. E., from 5th Bde., R.G.A., Tallaght, to R.G.A., Jamaica.

16/3/1921.

Burges, Capt. W., M.C., from Ordnance College, Woolwich, to H.Q. & D.E., Thames and Medway Defences, Sheerness.
Martin, Capt. (D.O.) R., M.B.E., from M.B. leave, ex-India, to 6 Depôt R.F.A., Glasgow.

17/3/1921.

Glaysher, Capt. (Bt. Maj.) W. E., from M.B. leave ex Aden, to H.Q. & D.E., Clyde and North Scottish, Gourock.
Gardner, Capt. A., from D.G.R. & E., Irish Comd., to H.Q. and D.E., Portsmouth and Portland.
Knowles, Major G. L., from D.G.R. & E., Irish Comd., to "Q" Coast Batty., R.G.A., Londonderry.
Warner, Lieut. H. J., from D.G.R. & E., Irish Comd., to 7th Bde. R.G.A., Fermoy.

18/3/1921.

Floyd, Capt. B. E., M.C., from R.A. Survey Company, Larkhill, to Capt. Instr. (I.G.) Survey, School of Artillery, Larkhill.
Maconochie, Lieut. H. A., from 9th Bde. R.G.A., Bordon, to II. Res. Bde., R.G.A., Catterick.

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R.G.A. Postings.—*Continued.*

19/3/1921.

Oxley, Lieut. M. S., from 6th Batty. R.G.A., India, to 11th Pack Batty., India.

21/3/1921.

Bryant, Lieut. C. H., from 23rd Batty. R.G.A., India, to 8th Pack Arty. Bde., India.
Ferguson, Major K. B., from Seconded List (Employed under Foreign Office), to R.G.A., Harwich.
Saxby, Lieut. (D.O.) W., M.C., from Half-pay List, to H.Q. & D.E., Tees and Tyne Defences, Tynemouth.

22/3/1921.

Colvile, Major A. M., D.S.O., from 2nd Pack Arty. Bde., Longmoor Camp, to 5th Pack Arty. Bde., Palestine.
Farrow, Capt. (D.O.) A. E., from R.H. & R.F.A. Records, Woolwich, to 4 Depôt R.F.A., Woolwich.
Miller, Lieut. A. G., from I. Res. Bde. R.G.A., Fareham, to 2nd Pack Arty. Bde., Longmore Camp.
Roche, Major L. V., from Comdg. Administrative Detch., Exp. Dept., Shoeburyness, to Defences, Carrickfergus.

24/3/1921.

Bird, Major M. H. C., from H.Q. & D.E., I-of-W., to R.G.A., Malta.
McGhee, Major A. S. P., from H.Q. & D.E., R.G.A., Portsmouth & Portland, to R.G.A., Aden.
Robinson, Major J. A. P., D.S.O., from H.Q. & D.E., R.G.A., Thames & Medway, Sheerness, to 1st Bde. R.G.A., Malta.

29/3/1921.

Bannister, Lieut. D. W., from 10th Bde. R.G.A., Larkhill, to 5th Pack Arty. Bde., Palestine.
Roupell, Capt. F. L. L. F., M.C., from Staff Capt. R.A., Aldershot Comd., to Adjt., 6th Cheshire & Shropshire Med. Bde. R.G.A. (T), Shrewsbury.
Smythe, Capt. V. G., D.S.O., from Staff Capt. R.A., Western Command, to Adjt., 12th Carnarvon & Denbigh Med. Bde., R.G.A. (T), Bangor.

30/3/1921.

Blease, Lieut. T. W., from D.G.R. & E., France, to "H" Coast Batty. R.G.A., Portsmouth.
Hire, Capt. D. A. H., M.C., from Staff Capt. R.A., H.Q., Eastern Comd., to Attd. H.Q., 4th Bde. R.G.A., Shoeburyness.
Hutchison, Major K. D., from "A" Coast Batty., Gullane, to R.G.A., Bermuda.

1/4/1921.

Ashley, Capt. J. O. M., from R.G.A., Gibraltar, to Sudan Detach. R.G.A., Egypt.
Borthwick, Lieut. H. G. E., from R.G.A., Malta, to Sudan Detach. R.G.A., Egypt.
Borthwick, Lieut. H. G. E., from Sudan Detach. R.G.A., Egypt, to 1st Bde., R.G.A., Malta.
Boyle, Lieut. L. H., from Nth. Irish C.D., Carrickfergus, to Sierra Leone.
Harwood, Lieut. W. P., M.C., from 1st Bde., R.G.A., Malta, to Sudan Detach., R.G.A., Egypt.
Parrington, Capt. L., M.C., from Staff Capt. R.A., Southern Comd., to Adjt., H.Q., & D.E., Plymouth and Falmouth.
Porter, Capt. G. T., from R.G.A., Channel Islands, Guernsey, to Sierra Leone.
Stirling, Lieut. W. G. P., from Sudan Detach. R.G.A., Egypt, to R.G.A., Malta.
Slade, Capt. (D.O.) R., from Garr. Adjt., Edinburgh, to H.Q. & D.E., R.G.A., Tees and Tyne, Tynemouth.

2/4/1921.

Finch, Lt. Col. G. F. C., D.S.O., from H.Q. & D.E., R.G.A., Tees and Tyne, Tynemouth, to 1st Res. Bde., R.G.A., Fareham.
Norman, Lt. Col. S. R., D.S.O., from Attd. Coast Artillery School, Shoeburyness, to H.Q. & D.E., R.G.A., Dover and Newhaven, Dover.
Stalkartt, Lieut. C. M. B., from "G" Coast Batty. R.G.A., Portsmouth, to Attd. No. 1 Pack Arty Bde., R.G.A., Bulford.
Van der Kiste, Lt.-Col. F. W., D.S.O., from Attd. R.G.A., Portsmouth, to H.Q. & D.E., R.G.A., Portsmouth and Portland, Portsmouth.

4/4/1921.

Swan, Lieut. O., from D.G.R. & E., France, to "M" Coast Batty., R.G.A., Dover.
Treatt, Capt. B. D. C., from Staff Capt., Scottish Comd., to "A" Coast Batty., R.G.A., Gullane.

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R.G.A. Postings.—*Continued.*

5/4/1921.

Bonney, Capt. J., from 1st Res. Bde. R.G.A., Fareham, to H.Q. & D.E., Tees and Tyne, Tynemouth.
Jackson, Lieut. L. H., from Singapore, to No. 2 Res. Bde., R.G.A., Catterick.
Wallace, Lieut. B. E., from 1st Res. Bde., R.G.A., Fareham, to H.Q. & D.E., R.G.A., Portsmouth and Portland, Portsmouth.

6/4/1921.

Kirkpatrick, Major C. D., M.C., from M.B. Leave, unposted, to 37th Batty., R.G.A., Larkhill.
Lawes, Major T. C., from Tank Corps, Egypt, to Sth. Irish Coast Defences, Queenstown.
Wilson, Major R. E., D.S.O., from ex India (Leave) to 38th Batty. R.G.A., Larkhill.

7/4/1921.

Riddell, Lt.-Col. E. V. D., O.B.E., D.S.O., from A.A. & Q.M.G., Sth. Eastern Area, to H.Q. & D.E., R.G.A., Portsmouth and Portland, I. of W.

8/4/1921.

Alexander, Major W. D., D.S.O., from Attd. Coast Arty. School, Shoeburyness, to R.G.A., Aden.
Bingham, Capt. C. H., from Temp. Half-pay List, to H.Q & D.E., R.G.A., Channel Islands, Guernsey.

11/4/1921.

Bayley, Major L. S., D.S.O., from 37th Ind. Mtn. Batty., India, to 10th Pack Arty. Bde., India.
Climo, Major P. H., from 2nd Ind. Mtn. Arty. Bde., to 9th Pack Arty. Bde., India.
Castle, Lt.-Col. R. W., C.M.G., D.S.O., from 35th Pack Batty., R.G.A., to 7th Pack Arty. Bde., India.
Carr, Major H. G., D.S.O., from No. 1 Ind. Pack Bde., Alimasjid, to Pack Arty. Depôt, India.
Greene, Major (Bt. Lt.-Col.) A. C. R., from 40th Pack Batty., Mespot., to 11th Pack Arty. Bde., India.
Grose, Lt.-Col. J., from Commandant Landour, India, to 2nd Med. Bde., R.G.A., India.
Haig, Major (Bt. Lt.-Col.) A. G., C.M.G., D.S.O., from No. 2 Depôt R.G.A., Gosport, to 8th Pack Arty. Bde., India.
Matthews, Major E. D., from Adjt., 6th Bde. R.G.A., to 7th Batty., R.G.A., India.
Richey, Major F. W., D.S.O., from 13th Ind. Pack Arty. Bde., Daurah, to 4th Pack Arty. Bde., Mespot.
Stanborough, Lt.-Col. L. K., D.S.O., from No. 11 Fire Command, Dover, to 6th Pack Arty. Bde., India.
Walters, Lt.-Col. H. de L., C.M.G., D.S.O., from 11th Pack Arty. Bde., India, to 3rd Med. Bde., R.G.A., India.
Cole, Major A. F., from Kashmir Imperial Service Troops, India, to 37th Batty. Pack Arty., India.

12/4/1921.

Ellerker, Capt. W. T., from Russian Course, unposted, to Intelligence Officer on probation to the Intelligence Corps, B.A. of Rhine.
McDiarmid, Major J. I. A., D.S.O., from T. & M. Coast Defences, to Command Ex Estab. Admin. Detachment, Shoeburyness.
Ramsey, Major (Bt. Lt.-Col.) H. A., D.S.O., from G.S.O. 2, 47th (London) Divn. (T.F.), Chelsea, to H.Q. & D.E., R.G.A., Thames and Medway, Sheerness.

14/4/1921.

Allen, Lieut. A. J. W., from Russian Course, to 1st Res. Bde., R.G.A., Fareham.
Parkin, Lieut. J., M.C., from D.G.R. & E., France, to H.G., R.G.A., Aldershot Command.

Cancellation of Postings.

Ramsey, Major (Bt. Lt.-Col.) H. A., D.S.O., from G.S.O. 2, 47th (London) Divn. is cancelled.
Mitchell, Major H., D.S.O., M.C., Posting to India, dated 5/3/21, is cancelled.
Kirkpatrick, Maj. C. D., M.C., posting to Mesopotamia, dated 12/3/21 is cancelled.
McGhee, Maj. A. S. P., D.S.O., posting to R.G.A. Aden, dated 24/3/21 is cancelled.
Barrington, Maj. J. F., D.S.O., posting to Pack Arty. India, dated 5/3/21 is cancelled

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R.G.A. Postings.—*Continued.*

Staff Appointments.

Blyton, Lieut. A. W., from 7th Bde., R.G.A., Fermoy, to President, Quartering Committee, 6th Divn., Graded Class G.G. 23/11/20.
Byrne, Major J. D., D.S.O., from G.S.O. 3, War Office, to Bde. Maj., R.A., Eastern Command. 1/4/21.
Churcher, Capt. G. M., M.C., from Mob. 2 C., War Office, to Chief Cipher Officer, Class F.F., Army of the Black Sea. 10/3/21.
Douglas-Jones, Capt. (Bt. Major) S. D., D.S.O., M.C., from Staff College, Camberley, to G.S.O. III., S.D.1., War Office. 1/3/21.
Eastwick-Field, Capt. W. L., M.C., from 1st Res. Bde., R.G.A., Fareham, to Chief Cipher Officer, Class F.F., G.H.Q., Egypt. 10/3/21.
Floyd, Capt. B. E., M.C., from R.A. Survey Company, Larkhill, to Capt. (I.G.) Survey School of Artillery, Larkhill. 14/2/21.
Neate, Capt. A. C. B., M.C., from G.S.O. 2, Black Sea, to Attached Officer, M.I.2.A., War Office. 18/3/21.
Pratt, Capt. F. W. H., M.C., from Staff Capt. R.A., 28th Divn., Army of the Black Sea, to Unposted. 24/1/21.
Reynolds, Major C. H., D.S.O., M.C., from Adjt., R.G.A. Plymouth, to Bde. Major R.A., Aldershot Command. 1/4/21.
Scovil, Major F. H., from R.G.A., Sierra Leone, to D.A.A. & Q.M.G., Sierra Leone. 21/3/21.
Walker, Capt. M. G. E., D.S.O., from R.G.A., Gibraltar, to Asst. Mil. Secretary, Gibraltar. 23/3/21.

REGIMENTAL LIST. The following Casualties have taken place from 16th March, to 15th April, 1921.

First Appointments.

Ford, W. T., to be Lieut. (D.O.), 19th March, 1921, from R.S.M.
Wark, Hector M.B.E., to be Lieut. (D.O.), 28th March, 1921, from Exptl. S.M.

Promotions.

Aggett, Capt. (D.O.) W. E., to be Major (D.O.), 28th March, 1921.
Colam, 2nd Lieut. J. A. R., to be Lieut., 23rd Jan., 1921.
Dowman, 2nd Lieut. J. P. G., to be Lieut., 23rd Jan., 1921.
Dowswell, 2nd Lieut. H. C., to be Lieut., 23rd Jan., 1921.
Easton, Lieut. (D.O.) W. T. J., to be Capt. (D.O.), 28th March, 1921.
Fletcher, 2nd Lieut. E. W., to be Lieut., 23rd Jan., 1921.
Hardie, 2nd Lieut. I. G. G. S., to be Lieut., 23rd Jan., 1921.
Hogben, 2nd Lieut. E. T. O'K., to be Lieut., 23rd Jan., 1921.
Jillings, 2nd Lieut. G. R., to be Lieut., 23rd Jan., 1921.
King, 2nd Lieut. R. A., to be Lieut., 23rd Jan., 1921.
Oakley, 2nd Lieut. C. V., to be Lieut., 23rd Jan., 1921.
Poland, 2nd Lieut. R. H., to be Lieut., 23rd Jan., 1921.
Porter, 2nd Lieut. P. G. H., to be Lieut., 23rd Jan., 1921.
Rees-Webbe, 2nd Lieut. E. H. N., to be Lieut., 23rd Jan., 1921.
Ridlington, 2nd Lieut. J. H., to be Lieut., 23rd Jan., 1921
Ronald, 2nd Lieut. A. J. D., to be Lieut., 23rd Jan., 1921.
Savile, Major L. W., D.S.O., to be Lt.-Col., 1st April, 1921.
Saxby, Lieut. William M.C., from half-pay list, to be Lieut. (D.O.), 26th Nov., 1918. (With seniority next above Lt. (D.O.) F. Templeton).
Stonehouse-Gosling, 2nd Lieut. P. le M. S., to be Lieut., 23rd Jan., 1921.
Tood, 2nd Lieut. A. C., to be Lieut., 23rd Jan., 1921.
Watkinson, 2nd Lieut. G. L., to be Lieut., 23rd Jan., 1921.
Wilding-Jones, 2nd Lieut. E. V., to be Lieut., 23rd Jan., 1921.

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To Half Pay.

Birtles, Lieut. H., 17th Oct., 1920.
Brown, Lieut. K. H., D.F.C., 13th March, 1921.
Deshon, Lt.-Col. F. G. T., 6th April, 1921.
Goodman, Lieut. W. J., M.C., 1st April, 1921.

Retirements on Retired Pay.

Adams, Lieut. F. J., from half-pay, 1st April, 1921.
Ayles, Lieut. W. W., from half-pay, 14th April, 1921.
Bailey, Major (D.O.) W. E., 28th March, 1921.
Calnan, Lieut. W. J., from half-pay, 23rd March, 1921, on account of ill health.
Churchley, Lieut. J., M.C., 24th March, 1921.
Collins, Lieut. F. C., M.C., from half-pay, 1st April, 1921.
Collinson, Lieut. H. T., from half-pay, 1st April, 1921.
Cooper, Lieut. W., from half-pay, 13th April, 1921.
Crawford, Lieut. C. W., 2nd April, 1921.
Croft, Lieut. F. W., from half-pay, 7th April, 1921.
Cullen, Lieut. P., from half-pay, 13th April, 1921.
deWinton, Lt.-Col. R. S., D.S.O., from half-pay, 24th March, 1921.
Dickens, Lieut. A. H., from half-pay, 15th April, 1921.
Dugan, Lieut. P., D.C.M., from half-pay, 1st April, 1921.
Edis, Lieut. S. W., from half-pay, 1st April, 1921.
Elliott, Lieut. F., from half-pay, 1st April, 1921.
Forbes, Major Hon. D. A., D.S.O., M.V.O., 17th March, 1921.
Gates, Lieut. H., from half-pay, 1st April, 1921.
Harpur, Lt.-Col. E. H., from half-pay, 15th April, 1921.
Harvey, Lieut. J. B., 15th April, 1921.
Hayward, Lieut. W. C., from half-pay, 16th March, 1921.
Heney, Lieut. A., 16th March, 1921.
Keefe, Lieut. E., from half-pay, 1st April, 1921.
Lane, Lt.-Col. F. C., C.I.E., from half-pay, 1st April, 1921. with Indian Pension.
McCarthy, Lieut. C. E. A., from half-pay, 1st April, 1921.
McGuinness, Lieut. W. T., M.C., from half-pay, 1st April, 1921.
Mahoney, Lieut. P. A., from half-pay, 1st April, 1921.
Maw, Lieut. W., 14th March, 1921.
Middlemas, Lieut. J. E., from half-pay, 1st April, 1921.
Mitchell, Lieut. F. A., from half-pay, 1st April, 1921.
Mosjen, Lieut. L. G., D.C.M., from half-pay, 1st April, 1921.
Mott, Lieut. C. E., M.M., from half-pay, 14th April, 1921.
Noakes, Lieut. F., D.C.M., from half-pay, 1st April, 1921.
Pearson, Lieut. T., from half-pay, 31st March, 1921.
Pelham, Lieut. A. H., from half-pay, 1st April, 1921.
Reynolds, Lieut. C., from half-pay, 14th April, 1921.
Robbins, Lieut. R. D., from half-pay, 1st April, 1921.
Robinson, Lieut. J. G., M.C., from half-pay, 13th April, 1921.
Searle, Lieut. W. A., M.C., D.C.M., from half-pay, 1st April, 1921.
Silvester, Lieut. A. H., from half-pay, 1st April, 1921.
Smith, Capt. J. C. T., from half-pay, 7th April, 1921.
Smith, Lieut. Jno. Michael, from halp-pay, 31st March, 1921.
Spackman, Lieut. J., M.C., from half-pay, 1st April, 1921.
Sterling, Lieut. C. S., M.C., from halp-pay, 1st April, 1921.
Thorpe, Lt.-Col. A. H., C.M.G., D.S.O., from half-pay, 23rd March, 1921.
Twidale, Lt.-Col. W. C. E., C.M.G., D.S.O., 1st April, 1921.
Twyford, Lieut. A., M.C., 23rd March, 1921.
Wallace, Lieut. T., from half-pay, 1st April, 1921.
Weeks, Lieut. P., from half-pay, 31st March, 1921.
Whiteman, Lieut. W., 18th March, 1921.
Woodhouse, Lieut. F. G., from half-pay, 6th April, 1921.

Retirements with a Gratuity.

Atkinson, Lieut. T. D., M.C., 12th April, 1921.
Griffiths, Lieut. R. F., 18th March, 1921.
Kelly, Lieut. S. J., 2nd April, 1921.
Rome, Major R. C., M.C., 15th March, 1921.

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Resignations.

Crofton, Lieut. R. C. M., M.C., 15th April, 1921.
Elliot, Lieut. R. N., 7th April, 1921.
Luard, Lieut. R. B. (on appointment to R.A.F.), 31st March, 1921.
Mousley-Lonergan, Lieut. E. J. H., 18th March, 1921.
Power, Capt. K. W., 2nd April, 1921.
Prior, Lieut. E. H., 8th April, 1921.
Smith-Pearse, Lieut. T. L. H., 31st March, 1921.

Deaths.

Barron, Maj.-Genl. Sir H., K.C.M.G., C.V.O. (retired), Col.-Comdt., 27th Mar. 1921.
Griffin, Major P., D.S.O., R.F.A., 26th March, 1921.
Holdich, Lt.-Col. G. W. V., D.S.O., R.G.A., 13th April, 1921.
Morris, Lieut. E., R.F.A., 24th March, 1921.
Seys, Major R. C., D.S.O., O.B.E., R.G.A., 10th April, 1921.

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GIFTS AND PURCHASES FOR THE MONTH OF APRIL, 1921.

Books Presented.

By The Secretary, War Office.

Catalogue of the War Office Library. Part III, (Subject Index). Ninth Annual Supplement (January to December, 1920.)

Handbook for the Q.F. 18-pr. Gun Mark IV, on Carriages, Field Marks III, IIIT, III*, & IV. Land Service. 1921.
Signal Training, Part VII (Provisional) Signal Organization, 1921.

By The Director of Staff Duties, War Office.

Report on the Examination for Admission to the Staff Colleges at Camberley and Quetta, held in February—March, 1921.

By The Publishers.

Nine Days: Adventures of a Heavy Artillery Brigade of the 3rd Army, during the German Offensive of March, 21-29, 1918. By Capt. A. F. Behrend. Cambridge (Heffer & Co.) 1921. 7/6 net.

The Framework of a Science of Infantry Tactics. By Capt. B. H. Liddle Hart. (Four Lectures given at the R.U.S. Institution and R.E. Institute.) Chatham (R.E. Institute) n.d. Hugh Rees, Ltd. 2/- net.

By Lieut.-Col. Lord Wynford, D.S.O., late R.A.

Shikar Notes for Novices. By The Hon. J. W. Best, O.B.E. Allahabad, 1920.

Books Purchased.

Out of my Life. By Marshal von Hindenburg. Trans. London (Cassell) 1920.

The Poison War. By A. A. Roberts. London (Heinemann) 1915.

Aircraft in the Great War. By Claude Grahame-White and Harry Harper. London (Fisher Unwin.) n.d.

Aircraft in Warfare. The Dawn of the Fourth Army. By F. W. Lanchester. London (Constable) 1916.

G.H.Q. (Montreuil-sur-mer). By "G.S.O." London (Philip Allan) 1920.

Tanks, 1914-18. By Lieut.-Col. Sir Albert G. Stern, K.B.E., C.M.G. London (Hodder & Stoughton) 1919.

The Campaign of 1914 in France and Belgium. By G. H. Perris. London (Hodder & Stoughton) 1915.

Modern Pig-Sticking. By Major A. E. Wardrop, R.H.A. London (Macmillan) 1914.

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The War and the Bagdad Railway. By Morris Jastrow, Junior. Philadelphia (Lippincott) 1917.

The Making of a Gunner. By "F.O.O." London (Nash) 1916.

Winged Warfare: Hunting the Huns in the Air. By Major W. A. Bishop, VC., D.S.O., M.C. London (Hodder & Stoughton) 1918.

A Nation in Arms, or a Militia? By Lt.-Genl. Baron von Freytag-Loringhoven. Trans. London (Constable) 1918.

The Motor Bus in War. By A. M. Beatson. London (Fisher Unwin) n.d. (1918).

A History of the War. By H. C. O'Neill. London (Jack) 1920.

The Inland Water Transport in Mesopotamia. By Lt.-Col. L. J. Hall. London (Constable) 1921.

At The Supreme War Council. By Capt. Peter E. Wright. London (Constable) 1921.

A Survey of Modern History. By H. W. Hodges. London (Blackie) 1919.

Canada. By A. G. Bradley. London (Williams & Norgate) n.d.

The Foundation and Growth of the British Empire. By J. A. Williamson. London (Macmillan) 1920.

British Administration in India. By G. Anderson. London (Macmillan) 1920.

Ludendorff. By General Buat. Paris (Payot) 1920.

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June, 1921.

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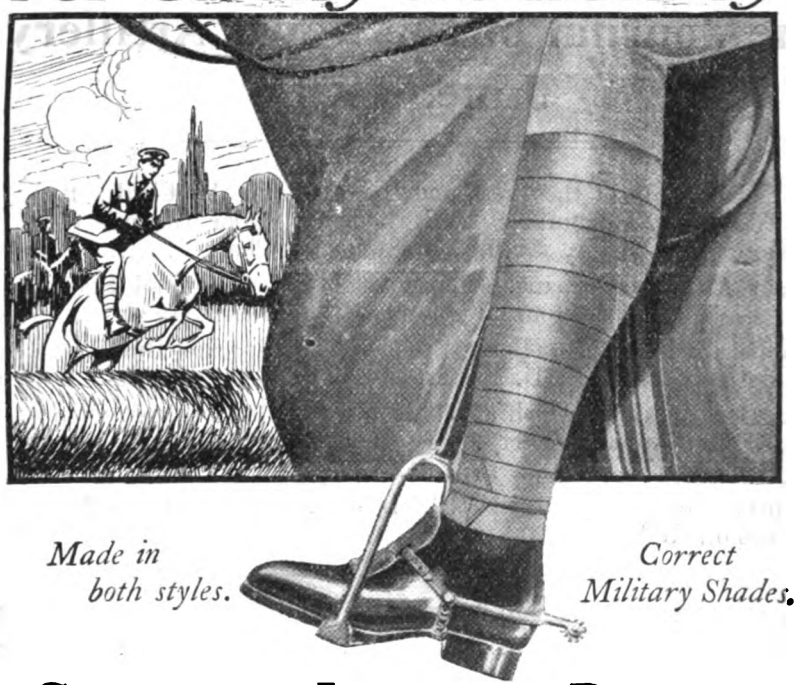

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THE RELATIONSHIP OF THE PRESS AND THE ARMY IN THE FIELD.

BY THE RIGHT HONOURABLE LORD RIDDELL.

Major General Sir John R. Longley, K.C.M.G., C.B., in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, I have much pleasure in introducing to you this afternoon Lord Riddell, who has kindly come down here to talk to us about the relationship between the Press and the Army in the Field. Lord Riddell has very great experience in all matters connected with the Press, and therefore I feel confident that we shall find that what he has to tell us is very much to the point. He was a Representative at the Peace Conference in Paris, and therefore he has a good deal of inner knowledge in all matters bearing on the Press and the Army. I will now ask Lord Riddell if he will kindly commence.

LORD RIDDELL: Ladies and Gentlemen: it is rather a terrifying thing for a civilian to address a number of soldiers on a subject of this sort; my excuse must be that during the War it was my task to represent the Press in their relations with the War Office, the Admiralty and the other Government Departments. I was therefore asked by General Longley, or the Secretary, I forget which, if I would say a few words to you on the relations of the Press with the Army in the Field. At the beginning of the war there is no doubt that the British effort was seriously prejudiced by the attitude of the War Office, and soldiers generally, to the newspapers. At that time the War Office was full of antiquated and exploded ideas concerning the question of publicity. I believe that Lord Wolseley had said that the newspaper correspondent was the curse of the modern Army. I have recently read a book by Major General Callwell on "The Experiences of a Dug-out." The Major General attempts to balance the scales between the Press and the War Office, but he says some pungent things concerning newspapers which show what his view was. At the beginning of the war he was head of the Intelligence Department of the War Office. He says, in effect, that the newspapers had swollen heads, and that they required to be kept in their place. He says pathetically that for some years the War Office had been the cock-shy of the young men on the newspapers, and that usually they made bad shots. No doubt, that was an opinion he would naturally hold; but he went on to say that the Press had been badly and unjustly treated. He did not say that because he had any sympathy with the Press, but because he thought that, from a public point of view, very serious errors had been made: in fact he says, in terms, that he was called upon to administer a policy which he believes to have been a mistaken one. It is surprising that there

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should have been these difficulties, because the situation had been envisaged by the War Office and the Admiralty, and a Committee had been set up called "The Admiralty, War Office and Press Committee," which consisted partially of representatives of the Press and partially of representatives of the War Office and Admiralty. I represented the London newspapers on that Committee. On July 27th, 1914, that Committee was hurriedly called together. Sir Graham Greene, the Secretary of the Admiralty, was in the Chair; all the newspaper representatives were away on their holidays. Sir Reginald Brade and an Officer from the War Office, and the son of one of my Press colleagues, Mr. Robbins of the Press Association were present. We sat round the table, Sir Graham Greene fidgeted with his papers a little, and then said "I have to make to you a very important announcement; it is quite possible that, in the course of the next few days, this country will be engaged in a war with Germany." We little appreciated the import of those few words. He went on to say: "It will be necessary to move battleships and troops, and I have asked you to come here for the purpose of consulting you as to whether it would be possible to do this without any publicity." We talked the matter over; there was a dirty piece of paper lying on the table, I picked it up, and in conjunction with my friend Mr. Robbins, drafted a letter, addressed to the newspapers, in which we told them, in very brief terms, that the country might shortly be engaged in war, that it might be necessary to move battleships and troops, and asking, in the interests of the Nation, that no mention of those movements should be made. I may say that at this time there was no statutory power to prevent the publication of information of that sort. I will not trouble you by reading the terms of the letter, although it is a rather historic document. It was followed by another letter, sent out on the 30th July, in which the request was somewhat extended, and there was also another letter on the 29th July. It is to the credit of the Press, that not a single newspaper mentioned the facts which it was desired to keep secret. The result was that the Germans, notwithstanding their wonderful Intelligence Department of which they boasted so much, and which let them down so badly, were unaware that the Expeditionary Force had started for France. On the 20th August they did not know how many men were there; nor was it known where they had landed. That was all due to the secrecy with which the movements were carried out. I mention these matters because they are really historic.

The critics of the Press at that time based their criticism usually on the ground that the Press was a commercial institution, and that newspapers make a profit out of circulating news. Well, that may be true, but the Press is also a patriotic institution, and I think you will agree, from the circumstances which I have explained to you, that, in this instance at any rate, the Press did a great service to the country by suppressing information which they were desired to keep secret.

Events moved quickly after that, and it is a matter for regret that the system which had been inaugurated so happily was not pursued. I forget the exact date, it would be some time in the early

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part of August, I was dining with a party at which Lord Kitchener was present. After dinner he told me that he intended to appoint a Press Censor, and pointing to Mr. F. E. Smith, who is now Lord Chancellor, Lord Birkenhead, he said: "There he is. Come and see me to-morrow morning and let us make the arrangements."

The next morning Mr. F. E. Smith and I, went to Lord Kitchener's room, and found him there surrounded by maps and generals, and under circumstances of considerable confusion. He was marching up and down the room giving orders, and so forth. I reminded him of his request that we should call to see him. I asked him what the duties of the Censor were to be. He said "To keep the Press from publishing anything of a dangerous character," and with that brief intimation he dismissed us and sent us to Sir Reginald Brade's room (Sir Reginald was then the Secretary of the War Office) to make the detailed arrangements. As a result of our Conference, Mr. F. E. Smith was installed in a disused and rat-infested building on the opposite side of Whitehall, where he had to commence his duties with a scratch staff. Considering the conditions under which he had to work, he did extremely well—remarkably well— and I think that the Nation owes a good deal to him, and to his brother now Sir Harold Smith, for the manner in which they set the organisation on foot. Lord Birkenhead subsequently explained that he was appointed in a three-fold capacity; first as a distributer of news; secondly, as an adviser to the Press; and, thirdly, as the person who would institute legal proceedings against the Press in case of a breach of the regulations.

On the 8th August 1914 the Regulations under the Defence of the Realm Act were passed. As you know, these affected the Press very considerably. There was no obligation under these rules to submit any matter to the Press Bureau. The newspapers were forbidden to publish certain matters, but they were free to publish at their own risk anything they thought fit. There was, however, a certain degree of Censorship exercised by the cable and telegraph Censors, who censored telegrams and cables coming to the newspapers. In some cases the cables were never delivered, and in others they were delivered in a truncated form.

Lord Birkenhead resigned in September 1914. He was succeeded by Lord Buckmaster, who resigned in 1915; and Lord Buckmaster was succeeded by Sir Frank Swettenham and Sir Edward Cook, who continued to act as heads of the Press Bureau until the Peace. There is no doubt that all these gentlemen did their best to secure more publicity regarding the doings of the Armies.

The original intention had been that Press correspondents should be sent to the Front, and the late Major General Stewart, a distinguished soldier who unfortunately was killed in the war, was appointed to act as Press Officer. The newspapers were asked to select their correspondents. They were told that no Press correspondent would be allowed to take a motor car, but that each Press correspondent must be provided with a horse. As a result horses were provided, and I believe that they were regularly ridden by the Press correspondents in Hyde Park for some weeks. I think the Press

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correspondents enjoyed the exercise a great deal; but after six weeks the War Office wrote to say that their previous intimation had been issued under a misapprehension—and that they now found that, owing to the long distances to be covered, motor cars would be essential and that horses would be useless. They therefore offered to buy the horses from the newspaper offices at the market price, and I believe that the newspapers sold them.

The demand for publicity continued; and there was a great deal of public uneasiness as to the silence regarding the doings of our soldiers. Eventually my friend Major General Swinton, (whom I daresay you all know as the author of the most delighful series of war stories which, I think, have ever been written) was appointed as Official Eye-witness. He went to France in September 1914, and was joined by Earl Percy in November 1914. These gentlemen continued to act until July 1915. Meanwhile there was grave dissatisfaction at home concerning the publicity arrangements. The newspapers were continually urging the War Office to allow the correspondents to go to the Front.. I may say that certain unauthorised correspondents had attempted to visit the scene of operations, and had been arrested and imprisoned. Eventually tours were arranged—on the Cook's principle, and a certain number of correspondents were taken round the Front. The first of these tours was in March 1915.

Early in that month the Press Bureau issued this notice : "Private and confidential, not for publication"—that does not apply now, there is no fear of the Defence of the Realm Act—"The magnitude of the British task in this great war runs serious risk of being overlooked by reason of exaggerated accounts of successes printed daily in the Press, and especially by exhibiting posters framed to catch the eye and magnify comparatively unimportant actions into great victories. Reported reverses to the enemy are proclaimed as crushing defeats, Germany is represented as within measurable distance of starvation, bankruptcy and revolution, and, only yesterday, a poster was issued in London declaring that half the Hungarian army had been annihilated. All sense of just proportion is thus lost, and, with these daily, and often hourly, statements of great Allied gains and immense enemy losses, the public can have no true appreciation of the facts or of the gigantic task and heavy sacrifices before them. The Director appeals to all those who are responsible for the Press to use their influence to bring about a better knowledge of the real situation, and rather to emphasize the efforts that will be necessary before the country can afford to regard the end for which we are striving as anything like assured. The posters, more especially those of the evening papers, are very often preposterous as well as misleading, and, at such a time, those responsible may fairly be asked to exercise a reasonable restraint, and help the nation to a just appreciation of the task it has undertaken, and the necessity for unremitting effort to secure the only end that can be accepted." The newspapers did not take that lying down; we thereupon addressed this letter to the Director, but in effect to the Prime Minister, Mr. Asquith : "My Council have had under consideration your memorandum of the 12th March for which, in their opinion, there is no adequate justification.

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The Press has dealt faithfully with the news furnished by the naval and military authorities, but it may well be that the public misunderstand the situation and that this misconception is producing serious results. If, however, the people are being unduly soothed and elated the responsibility lies with the Government and not with the Press. In this connection my Council desire to direct your attention to the optimistic statements of the Prime Minister, Sir John French, 'Eye-witness' and other persons possessing official information. The Press acts upon the news supplied. If this is inaccurate or incomplete the Government cannot blame the newspapers. My Council desire to represent to the authorities that the methods now being adopted are fraught with grave public danger. Ministers are continually referring to the importance of energy and self-sacrifice on the part of the industrial population, who cannot be expected to display these qualities unless, generally speaking, they are acquainted with the facts. In dealing with the news the naval and military authorities should consider not only our enemies and the army in the field but the commercial and industrial classes at home, upon whom so much depends. It is futile to endeavour to disregard the long-established habits and customs of the people." The result of that letter was that Mr. Asquith invited the Press to a conference. Eventually it was arranged that Lord Kitchener and Mr. Churchill the head of the Admiralty should see a representative of the Press each week, for the purpose of furnishing such information as could properly be furnished for publication, and also secret information for the information of editors. I was told off (I believe you call it "detailed" in the Army)—I was detailed for this duty and I went to see Lord Kitchener once a week. The interviews were very interesting. Lord Kitchener has been compared by a friend of mine with a lighthouse—a very good comparison: he would cast out great flashes of light and then there would be periods of darkness. When he was in form, that is to say when the light was burning, he was most illuminating; when the light was dark or darkened he did not seem to be the same man as on other occasions. On looking through these memoranda of my interviews with him I am struck by his amazing sagacity, and by the remarkable accuracy of what he said and the prophecies that he made. It is not for me, on an occasion of this sort, to trouble you by reading to you the memoranda which I issued to the Press, except in so far as concerns the subject of these remarks, but I propose, with your approval, to read to you one or two reports which I made of interviews I had with Lord Kitchener regarding the correspondents in the Field. On the 16th April I wrote: "War Correspondents." I stated the Council's views to Lord Kitchener in some detail. He dealt with the matter at length in reply. He explained that the rules for the conduct of the war have been made by the General in Command of the French Forces. One of these rules is that no correspondents shall be allowed to accompany the troops. So long as this rule obtains it must be observed by the British Military Authorities. I asked Lord Kitchener whether correspondents would be permitted to accompany the British Army if the English newspapers were able to prevail upon the French Commander to alter his decision. His answer was that if the rule

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were altered the change would apply to the British as well as to the French Army. I further asked him whether he would place any obstacle in the way of the alterations. He answered in the negative, and added, "The French Commander is responsible for the campaign which is being carried on in his country, and the major part of which depends upon the French troops." I asked whether there would be any objection to the Press endeavouring to prevail upon General Joffre to alter his regulations. He replied 'Not the slightest, but the application must not be made as if I were a party to it. General Joffre has made the rule, and I act loyally in conjunction with him in this as in all other matters. He considers the rule necessary for the safety of France, and even if we disagreed with any of his regulations we should be acting wrongly if we did not loyally abide by his decision.'

On the 23rd April, I had another interview with Lord Kitchener in the course of which I communicated to him the views of the Council of the Newspaper Proprietors Association and read to him extracts from a letter in which Lord Northcliffe expressed strong views as to the necessity for appointing correspondents. I also had received a communication of a similar character from Lord Burnham, who is the President of the Association. Armed with these and resolutions of the Council I again attacked Lord Kitchener. He said that an official intimation from French Headquarters would be necessary before he could depart from the arrangement entered into with the French Military Authorities, but suggested that immediate arrangements should be made for another visit to France of a limited number of British newspaper correspondents; he thought four or six. These correspondents went to the Front. They never returned: not that they were killed off, but there they remained; we were never asked to bring them back and we never brought them back. Lord Kitchener never recognised them as being there, he never asked after their health; I suppose he must have read their despatches in the papers, but he never referred to the subject, and we thus won the battle in which we had been engaged; namely, the battle for publicity. I may say that similar arrangements were also made in regard to the other campaigns; correspondents were allowed to go to the Balkans and elsewhere. We also arranged with Lord Kitchener to send us privately every week a list of the casualties which gave, although a very tragic thermometer, a very useful thermometer for the purpose of showing the editors how the war was proceeding.

I suppose you all know that there was a great deal of criticism of the Censorship, some of it was justified; but, looking back, I am surprised that the system worked as well as it did. Full use was not made of the Admiralty, War Office, and Press Committee, no general principles were ever laid down for the guidance of the Censors, and when one thinks of the multiplicity of matters involved, and of the amazing issues involved, it is really surprising that there was not more cause for criticism. No concordat was ever reached between the Press and those responsible for censoring the matter; there was no agreement between the Press and the authorities as to what should and should not be published. However, as I have said, the system worked better than could have been expected.

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So far as the future is concerned, I am sure you all hope that we shall not have another war. It would be a disaster which one cannot contemplate with equanimity. We have heard a great deal about new worlds and new ideals. I confess that I am a man of peace; at the same time it is useless to conduct your affairs as if you were living in an ideal world when the ideal world does not exist, and when other Nations are not acting as if it did. Some reference was made by you just now, Sir, to the fact that I had been at the Peace Conference. I have been at many Peace Conferences. It is a curious reflection, which will no doubt provide matter for future historians, that while the delegates at the Peace Conference were busily engaged in forging the League of Nations (from which we all hope so much) one of the countries, which at any rate was one of the chief movers in those proceedings, was, at the same time, engaged in forging armoured plates in another place to provide for a very different contingency. It is not for me to criticise actions of that sort; but we should be acting very foolishly, in my humble opinion, if we were to conduct our affairs on lines different from those on which the affairs of other Nations, with equally peaceful intentions, are being conducted. That is my excuse for coming to speak here this afternoon. Publicity is an essential part of modern warfare. It is just as necessary to make preparations in regard to publicity as it is to make preparations in regard to munitions of war. It should be understood that modern wars are conflicts between Nations not conflicts between armies. It should be understood that a complete and friendly understanding between the Army and the Press is a vital necessity of any war. You can only get good results by mutual confidence and goodwill. There must be tact and forbearance on both sides. It is always well to be frank with journalists. It is always well to tell them the truth, but to indicate what they should not say. Well-devised regulations are useless unless they are carried out by sensible and competent people. Our experience is that youngish soldiers are the best Censors. We have a strong objection to dug-outs. Dug-outs are not suitable for this purpose. I believe they have very valuable uses in time of war, but they are not useful as Censors. It is much better to have young, or middle-aged, officers on the Active List. It is very important that a certain number of officers should be trained in these matters. It is important that they should have opportunities of coming into contact with journalists. At the beginning of the war I think many soldiers thought that journalists were liable to bite, and were very dangerous people. Well, when you get to know journalists, you find that they are most innocent and unoffending creatures; and that they live a harried life. They are most anxious to do the right thing, but they have professional zeal, and they are therefore anxious to get "scoops," and to do the best for their respective papers. Long experience has proved to me that there is no one who can keep a secret so well as a journalist; the reason is that journalists are the repositories of secrets; if you put a journalist upon his honour you can really tell him almost anything. Therefore it is well that in peace times a certain band of officers should be trained for these purposes, and that they should have opportunities of coming into direct contact with newspaper people. In

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this connection it is most important that proper arrangements should be made in regard to the publication of photographs. In these times the photograph occupies a very important place in publicity. Therefore persons should be employed to photograph the doings of the Army in the Field—persons who are acquainted with the necessities of Press photography, and persons who can be relied upon to abstain from taking pictures which should not be taken.

It would not be right that I should close these remarks without paying a tribute to the Press correspondents. I expect that most of you here served in the war—you know what it was. You know the stress and the strain, you know the terrible conditions under which men were called upon to live and work. You can, therefore, perhaps appreciate better than other people the difficulties of the task of the newspaper correspondent who is not a soldier, who is called upon to undergo serious privations and dangers, and who, at the same time, is required, at very short notice, to turn out two or three columns of matter every day, and to comply with strict censorship regulations. That is a very trying task. I do not wish to compare a newspaper correspondent with the soldier. I think, if I may say so, that the soldier in the trenches was the man who won the war, and the man who is entitled to our gratitude; he was the man who risked his life and who underwent privations and dangers which cannot be described. At the same time the newspaper correspondents did their part, and, if I may say so, they did it nobly. They never hesitated to risk their lives, and I think if you were to examine to-day, in cold blood, the despatches which were sent from the Front, you would find that their literary excellence was remarkable under the circumstances. The effect of these correspondents' work was to enable the Nation to carry on the war. The Nation was heartened and interested, and I think we all owe much to the newspaper correspondents.

Since I spoke on this subject the other day at the United Service Institution, two books have been published of considerable interest. The first is a book, or pamphlet, which is called, I think, "Diplomacy by Conference". It is written by my friend Sir Maurice Hankey, Secretary of the Cabinet. His point is that despatches and letters are out of date, and that the best method of carrying on international negotiations is by means of Conferences. I daresay he may be right, but I wish to add that what the world needs is open diplomacy. The world wants to know how its affairs are being carried on. Dark places breed all sorts of dangerous diseases. It is an essential of modern life that the people should know what is being done in their name. The other book is a book by Captain Peter Wright, formerly Assistant Secretary of the Supreme War Council—a very remarkable book, I do not know whether any of you have read it; I daresay some of you have read the reviews of it. It is not for me to comment upon what the author says; he says some very astonishing things. If they are true, they are very serious things; if they are not true, they ought to be contradicted. The reason I have mentioned the book is because it bears on my subject; he devotes a considerable part of his observations to the action or alleged action of certain persons high in authority, who are said to have communicated information to Colonel Repington.

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If what this gentleman says is accurate, then I think his comment is justified. He says it is an astonishing thing, that, at a time when the Press was being heavily censored, when Officers and men were not permitted to disclose information without incurring the severest penalties, persons in high authority were communicating the most secret details to a journalist. I know you are all interested in these matters, and I should strongly advise you to read this book. I read it last night, and I think you will say it is one of the most astonishing books that have appeared for many years past.

Naturally I do not object to publicity, but what I do say is this; that if you have a rule it ought to be observed by everybody. It is not right that junior officers and men should be required to observe rules which are broken by those in high authority. I would also say this; that, while I am all for publicity, I regard it as a matter of absolute importance that no information should be supplied to the Press, or anyone else, regarding forthcoming military operations. That information should be kept secret. Experience shows how many well-devised operations failed because information concerning them leaked out beforehand. I believe that one of the reasons why Marshal Foch proved to be so successful was that he did not communicate his intentions to more than one or two people. The result was that they were concealed.

Well, ladies and gentlemen; I have kept you a long time; I do not know whether I have told you anything that you did not know before, but I will close my remarks by stating once more that if, unfortunately, we should be engaged in another war, it is of the utmost importance that the Nation should march hand in hand with the Army. If that object is to be achieved, it can only be secured in one way, and that is by the Press marching hand in hand with the Army. You must have mutual understanding, you must have mutual goodwill, you must have mutual agreement. Without that no modern war can be waged. It is impossible for any war to be carried on which does not secure the approval of the people. There is another matter that I should like to mention. I said just now that we are all anxious for an ideal world. Of course, I have no doubt that would mean that many of you gentlemen would have to take to civilian employment, but I daresay you would find it much more profitable than the employment which you have at the present time. If I might say so I think it very important, so long as we have the sort of world we have got just now—I hope it will not last long, I hope it is going to change—but so long as we have a world of this sort in which sailors and soldiers are necessary—necessary evils—it is very important that sailors and soldiers should interest the public in Naval and Military pursuits. It is essential that the people of this country should recognise that Naval and Military Institutions are necessary for their safety. I should like you to imagine what would happen to our country if to-morrow morning the order were given to sink all our battleships, spike all our guns, discharge all our soldiers and destroy all our rifles and munitions. I would like to ask you what position we should be in. Perhaps you can conceive better than I can. The Millennium not having arrived, I rather imagine that before very long certain other

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Nations would crucify us in the same way as other pioneers have been crucified. That is my excuse for coming here this afternoon. I am not a military man, I am a civilian, I am a man of peace, but from my little angle, namely, the angle of publicity, I think that, until we get the ideal world, it is just as well that the public and the Navy and the Army should realise the importance of publicity, and the importance of good relations between the Press and the Navy and the Army, who are the honoured servants of the public.

THE CHAIRMAN: Would any lady or gentleman like to ask the lecturer any question?

COLONEL COMDT. G. H. A. WHITE: I should like to ask the name of Peter Wright's book.

LORD RIDDELL: You must understand that I do not know Captain Wright. I know that he did hold this position. The name of the book is: "At the Supreme War Council," it is written by Captain Peter Wright, late Assistant Secretary of that body. Whether what this gentleman says is true or not I cannot say; he gives chapter and verse for what he says, but to you military gentlemen it will be, I think, an amazing surprise.

COLONEL FASSON: You said that it was very desirable the country should take an interest in Naval and Military institutions; I think it is rather difficult for soldiers to get them to do that, and what I suggest is, that the Press should help towards that end. I think the country does take extraordinarily little interest in them, but it is rather difficult for us to persuade them to take an interest.

LORD RIDDELL: In answer to that, I may say that the Press is like a dog: if you pull his tail he barks. It is a mistake to think that newspapers go in for propaganda, or that they go in for pushing movements: The Press is a recording institution which records and comments upon what happens from day to day. What I mean for instance is, supposing one of you gentlemen attends a dinner and makes a speech you may take the opportunity of saying interesting things about the Army. It is not a question of propaganda at all, perhaps you only tell them a few military stories; you tell them something that has happened about the war; those actions on your part keep before the public the fact that we have got an Army, and prevents them from forgetting the wonderful things which were done by all those wonderful men during those extraordinary five years.

CHAIRMAN: If no one else has any question to ask the lecturer it only remains for me, on behalf of all here present, to tender him our deep thanks for coming here this afternoon, and helping us to know a bit more about the relations of the Press with the Military forces of the country. I do not think that any of us really have been antagonistic to the Press. I know that we have the reputation of having been so in the past, but I think things have changed considerably, and people's views have changed, and perhaps (although I ought not to say so myself) many of us are younger now in the positions that we hold than we were before the war; and that being so, perhaps our ideas are more in accordance with those of youth, at any rate I think that all of us realised, during the war, the desirability of publicity, of making known the actions of those men with whom we

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were serving, and the extraordinarily fine deeds that were being done; and when those were published we realised the benefit that it was to them to see that their deeds were appreciated; and also I think it was a great comfort and a source of pride to the people at home to realise what their belongings and fellow countrymen were doing; and, if for no other reason than that, we all realised how desirable it was that there should be publicity. There is another thing I am sure we are agreed upon, and that is the patriotism of the Press. Another point, which I do not know that we are all quite so agreed upon, is, I think, that there is no doubt but what the Press can do a great deal of good in educating the mind of the public. Lord Riddell says that the Press does not initiate. I do not know whether I am right in my idea, but I thought that they did—on occasions. I think it is a great pity that they should not in these days. Surely, now, at the present time, they can do a great deal of good in the way of education. I am afraid it will be a long time before soldiers can accustom themselves to talk sufficiently about deeds that have been done, and help the Press in the way perhaps that the Press would like them to. But, if anything comes of the suggestion that, during the years of peace, Officers should be taught, and should be attached we will say to the Press to learn how to censor in war time, I think that possibly the Press may get more copy, certainly by what they hear from those Officers. I am afraid I am no good. I am evidently past the age for applying for a job like that myself, but there are plenty of younger ones here who I am sure will be very ready to apply for billets like that. I would only say, in conclusion, that if other journalists have the same suave and tactful way in which they go about their work as we have seen Lord Riddell has had this afternoon, I am sure our co-operation with them would be very very easy. There is no doubt we want a little sympathy and goodwill on both sides, and then I hope that, if there is another war, we may find that the publicity methods are not so behind-hand as they were in the past. I will now conclude by thanking you very much for what you have told us this afternoon and having taken the trouble to come here.

Lord Riddell: Thank you very much for your kind response. I think perhaps the General rather misunderstood what I said as to the appointment of Press representatives. He evidently thinks that the intention is that distinguished officers of the junior ranks should be seconded (is that right?) to newspaper offices. That was not our view. Our idea rather was that there should be a trained body of officers in the Army who were acquainted with these subjects and who had studied them. We also think that during manœuvres, certain officers might be told off to act as hypothetical (if I may put it in that way) Press Officers, so that they would get to know the ways of journalists, and would have an opportunity of discussing with journalists censorship methods. I thank you very much; it is a great honour to be allowed to come and speak here; and, as I said just now, it is rather an embarrassing and terrifying experience for a civilian like myself to be called upon to address a body of soldiers who know perhaps a good deal more about these matters than I can ever hope to do.

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FRENCH ARTILLERY DOCTRINE.

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HOW has the war affected French artillery doctrine? To answer this question is to describe the doctrine taught in the French artillery to-day, which naturally embodies the teachings of the war as regards the tactical use of artillery. What follows represents the French artillery doctrine as taught at the Centre of Tactical Artillery Studies at Metz, as shown in the field service regulations for the artillery, and, finally, from a long experience with the French artillery, during which time the occasion has arisen of hearing the opinion concerning the use of artillery from innumerable officers of that arm. The value of the French artillery is too well known to require emphasizing the interest of their doctrine.

It is logical to commence this study with a brief historical sketch of the French artillery before and during the war. The faith in their 75 as a universal weapon had the unfortunate effect of minimizing the importance of heavy artillery. As a consequence, at mobilization there were 3840 guns of 75 mm. calibre, and only 308 pieces of heavy artillery whose range and power were small compared with later developments. For the 75's there was an ammunition supply of 1300 rounds per gun; and the regulations, in view of the available amount of ammunition, anticipated a rather weak density of fire, and recognized the necessity of being satisfied with neutralization effects with a small number of projectiles. Finally, the artillery was to be used, not to *prepare* the attack of the infantry, but to *support* it.

The division with its 4 regiments of infantry had only 3 groups of 75's, or, in other words, the artillery only represented a fifth part of a division. This fact illustrates the minor importance of the artillery at that time.

During the first months of the war the following vital changes in the use of artillery were seen to be required, and the following conditions clearly realized:

1 The necessity for closer liaison between the artillery and infantry.

2. Necessity for artillery to prepare the attack of the infantry.

3. Importance of heavy artillery.

4. Tremendous power of artillery fire.

With the stabilization of the front, the methods of the artillery change. The field artillery adopts the methods of the fortress artillery; the development of topographic methods commences, and map firing appears. Terrestrial observation becomes more common, and the telephone grows to be a most important adjunct to the artillery, with the result that it is possible for the B.C. to command his battery from a distance.

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The necessity for a great density of fire becomes obvious, and the final proof of the power of artillery is given in 1916 at the battle of Verdun. The barrage appears, but as a defensive form of fire soon gives way to the counter-preparation system, which is much more effective than the defensive barrage.

At Metz no opportunity is ever lost to emphasize this fact that proved to be the great lesson of this battle, viz., the great density of fire required if it is desired to produce a really effective action in the battle. The fact is recognized of "the overwhelming power of fire *when concentrated,* the destructive power of counter-battery fire, and, on the other hand, the insignificant results obtained from scattered reprisal fire, answering fire, etc., which last, if not completely abandoned, are greatly altered."[1]

Finally, in 1918, such progress has been made that it is possible to make surprise attacks, which, in spite of that fact, have ample artillery preparation, and which succeed.

DISTRIBUTION OF ARTILLERY IN BATTLE.

After the foregoing brief résumé of the changes in artillery doctrine during the course of the war, it will be interesting to see what is recommended concerning the distribution of artillery to accomplish its missions, which are defined as "opening the way for the infantry by destroying the obstacles opposing its march, i.e., hostile forces and defenses (offensive action); hindering and occasionally even preventing, before they start, offensive preparations of the enemy, and contributing to the rapid reëstablishment of the equilibrium of forces to the advantage of the defence (defensive action)."

The leading thought relative to the distribution and assignment of artillery to large units is this: Avoid scattering of the artillery, and favor as far as possible its mass action.

On October 25, 1918, a note published by the French G.H.Q. concerning the use of divisional artillery defined the following requisites for the artillery:

1. A close liaison between artillery and infantry, so as to coordinate the efforts of the two arms.
2. Power of the artillery in surprise actions, the massing of artillery, and concentration of fire.

In order to attain these ends there must be:

1. An organization of the artillery in groupings;
2. Distribution of fire in zones of action.

It is now laid down that the mission of direct support of the infantry is always the function of divisional artillery. The artillery duel, being to a certain extent independent of the infantry combat, should be carried out on as wide a front as possible, this front being a function of the range of the artillery available for this purpose. This defines the duty to be assigned the corps and sometimes the army artillery. Finally, firing on enemy communications is assigned

[1] Colonel Maitre.

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to the artillery of a large unit on the principle that the farther these communications lie from the battle front, the higher is the large unit whose artillery will be assigned to this class of fire. This will consequently be another duty assigned corps and army artillery.

The quantity of artillery employed would often make the exercise of command very difficult within the divisional corps and army artillery. It consequently results from this that it is necessary to coördinate these organic units into groupings whose organization would obey the following rules:

"(*a*) Unite under the same command units having analogous missions in such a way as to facilitate the search for and the exploitation of information as well as the operation of the service of observation.

"(*b*) Respect organizations whose maintenance is indispensable to a proper output return from the units, i.e., regiments or battalions. The nucleus or total of each grouping should be constituted by a regiment whose commanding officer has a staff and the necessary adjuncts, or should be found around such an organization.

"(*c*) Form the groupings with 3 or 4 battalions as a maximum, this organization assuring the best return in the matter of the transmission of orders.

"(*d*) Adapt the groupings to the situation of the large or small units with which they are coöperating.

"(*e*) Be able to lend itself with considerable flexibility to all circumstances of the combat. The distribution in groupings must never be according to a fixed rule, but must be capable of modification according to the course of events." (Field Artillery Regulations, 1919.)

In organizing the command of the artillery in accordance with the conditions just described, it is well to remember the difficulty of command which is inherent to the artillery.

The proper use of artillery requires perfect accord between all the executives involved; unlike the infantry, which, once started in an attack, does not change its mission or receive additional orders or instructions, the artillery has to change its mission and its targets constantly, change its position, change from one kind of fire to another, and change targets.

The artillery thus manœuvres constantly, and that is the reason why separating it and scattering it on the battlefield, and distributing it in weak units which escape the action of the higher commanders, are things always to be avoided. In addition to its normal missions, the artillery of each large unit is used to reinforce the artillery of every large unit, according to the requirements of the situation. It is indispensable that all possible density of fire should be concentrated against a dangerous or annoying target, which, under normal conditions, would only be insufficiently fired upon. In this way divisional artillery coöperates with the corps artillery, and army artillery with the corps and divisional artillery in case of necessity.

The location of the P.C's. under such conditions consequently becomes a question of the utmost importance. "They must be located in such a way as to give the command of subordinate units the

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necessary communications with higher authority, and a proper supervision of the field of battle." With the reservation that these requirements are satisfied, it will always be advantageous to place together a P.C. of a grouping for direct support with the P.C. of the infantry supported; a P.C. of a corps artillery grouping with the P.C. of a divisional artillery; a P.C. of an army artillery grouping with the P.C. of a corps heavy artillery grouping, or with a P.C. of a corps artillery grouping.

The commanding officers of battalions and batteries ordinarily have a technical mission in the conduct of fire, and are normally with their units.

MOVEMENTS OF THE ARTILLERY.

During the period of stabilized warfare, batteries tended to lose their manœuvring ability, but, due to the effectiveness of gas bombardments and counter-battery firing, in 1917 and 1918 the artillery learned that flexibility of manœuvring was as important as flexibility of fire. The new artillery regulations are particularly elastic as regards the movements of artillery, but prescribe the reduction during battle to a minimum of changes of position. To accomplish this, the original distribution of the artillery must give a sufficient echelonment in depth; the entire field of fire and the range of the matériel must be exploited; and, finally, all changes of position should be of considerable extent, else they are not justified.

In laying down the new regulations, the following conditions are taken into consideration, as requiring changes from pre-war regulations relative to changes of position by the artillery:

1. Emphasis on the importance of the factor of surprise.

2. The development of aviation, and the consequent ability of the enemy to observe all movements.

3. The great increase in the relative and absolute quantity of artillery which can be placed in action.

4. The various forms of warfare to be anticipated from the war of stabilized fronts to the war of movement.

OBSERVATION.

The organization of the observation service remains practically what it was at the end of the war, i.e., by aeroplanes, by balloons, from terrestrial observation stations, and sound- and flash-ranging sections, which are included in this service.

Artillery observation is defined as maintaining a look-out over the field of battle, reconnaissance and study of targets, adjustment and control of fire.

There is a strong feeling that there was and is not sufficient coördination between the aerial observer and the artillery. The air service, being in charge of the aerial observation, is more interested in questions of aviation than in questions of observation.

The recommendation is heard that an aviation be created for the artillery. In other words, squadrons would be assigned exclusively to the artillery of large units exactly as they were assigned during the war to units of the general artillery reserve.

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In the French Army sound- and flash-ranging sections and the telemetric sections are not part of the Artillery, but are in the Geographic Service.

The new artillery regulations prescribe that the principal usefulness of these sections would be in war on a stabilized front, but that with proper training and equipment, they can render most valuable service in a war of movement, and prescribe regulations for handling these sections in an advance. As far as these sections themselves are concerned, there will be at least one assigned to each army corps.

As already indicated, there is little or no change in the present regulations concerning observation from the regulations in force at the end of the war, and consequently the discussion of this subject will not be prolonged.

COMMUNICATIONS AND LIAISON.

In France there is no Signal Corps, and the so-called Military Telegraph Service is operated by the 8th Regiment of Engineers. At the end of the war there were nearly 50,000 men in this regiment, and, in addition to this, a large number of men in all units were employed on the service of communications. There is a firm belief that the future will see a great development in the importance of communications, so that even a greater proportion of personnel will be assigned to this duty. It seems probable that the French army will retain the organization they now have, and will not form a separate Signal Corps. The recommendation has, however, been made that each regiment of artillery should have a specialized signal detachment consisting of a company of about 200 men, from which one section would be assigned to each group, and a squad to each battery, the remainder being retained by the headquarters of the regiment for general purposes. There should be three distinct lines or circuits specialized as follows:

System for the command;
System for the artillery;
System for general purposes.

The artillery telephone system should have centrals located close to the command telephone lines, but distinct, in order to avoid too much crowding of the line.

As regards the quantity of telegraph apparatus to be placed at the disposal of a regiment, it has been recommended that each regiment and each group be supplied with an amplifier, each regiment with a wireless station, using undamped waves, and, finally, each regiment with six wireless telegraph sending and receiving posts and five ground telegraph sending and receiving posts.

The maintenance of the optical signal apparatus is recommended, but not in its present form, which should be greatly improved.

The question of liaison is covered in special regulations, and simply mentioned in a general way in the artillery regulations. It is believed that during a war of movement the maintenance of liaison between artillery and infantry must generally be ensured by means of messengers on motor cycles and mounted messengers.

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In designating liaison agents, the army and corps artillery, as a general rule, detach a liaison officer with the subordinate artillery units; but within the divisional artillery and the heavy corps artillery the subordinate unit detaches a liaison agent, either an officer or enlisted man, with the next higher unit.

It is expected that lateral liaison of artillery units can generally be secured by telephone. Whenever a grouping, sub-grouping, or group of field artillery or heavy artillery is charged with the direct support of an infantry regiment or battalion, such artillery unit detaches an officer who is designated Chief of the Liaison Service with the commanding officer of the infantry unit.

This Chief of Liaison Service has under his orders a liaison detachment, and sometimes an observation detachment.

This officer must belong to the staff of the unit which detaches him. The detachment consists of non-commissioned officers and liaison agents, telephone operators, signalmen with the necessary material, such as telephones, flags, Very pistols, etc., and, when an observation detachment is included, the necessary trained observers.

The mission of this liaison detachment consists in informing the commanding officer of the unit from which it is detached concerning the situation and the needs of the infantry, and in transmitting information which indicates what is required of the artillery. Moreover, it must be able to inform the infantry commander concerning the support which the artillery it represents can give the infantry.

The chief of liaison makes all reconnaissances with the infantry commander whom he supports, and during combat remains with this officer. He takes advantage of every lull in the combat to advance or repair the direct artillery telephone line between the liaison detachment and the unit to which he belongs, and even when there is no definitely specified observation detachment under his orders, he may be called upon, during the combat, to observe or adjust the fire for his unit. The infantry commander must give the following information to the artillery liaison officer.

1. Before the attack, his plan of engagement, his orders of attack, and his mission.

2. During the attack, all information which he receives concerning the situation of his front line, the front of the enemy, and his own intentions.

The chief of liaison must know the plan of employment or the plan of action of the artillery unit from which he is detached. He must be kept in touch with the daily operations orders, and all orders supplementing or modifying the plan of employment.

CONDUCT OF FIRE.

The French artillery continues to base its instructions concerning the preparation of fire on the regulations which were well known to American artillerymen, as published in "Artillery Firing." There is but little criticism of the methods, although it has been proposed that the new firing regulations should devote more space to the preparation

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of fire in war of movement. However, the French artillerymen believe that the basic instruction should be on the principles used at the end of the war, and that instruction in the rapid preparation of fire for open warfare will then be a simple process, after the more difficult and technical details of the preparation of fire, using carefully prepared maps and all other data employed during the last years of the war, have been mastered.[1] As a matter of fact, the new Firing Regulations (1920) devote ample space to a discussion of rapid preparation of fire, which would be the only methods available under certain circumstances.

In the training of field artillery regiments at the present time the greatest emphasis is laid on instruction in topographical and astronomical processes, looking towards as complete an instruction in topography as can possibly be given both officers and noncommissioned officers.

The meteorological service to be used in connection with the preparation of fire is capable of improvement, so that the information from the meteorological units will be completed and transmitted quickly to the batteries.

Recommendation has been made that mobile meteorological sections for determining azimuth and velocity of the wind should be assigned to the divisional artillery and to the heavy corps artillery, and, further, that with the same end in view, kites should be furnished regiments of field artillery.

As far as the rules of fire are concerned, there is general satisfaction with the processes in force at the end of the war, although many artillerymen believe that the rules of fire in force before the war should be reintroduced into the regulations.

On the other hand, certain officers express themselves as being convinced that the artillery should develop with a view to completely eliminating fire adjustment.

The principles of the 1910 regulations, supplemented by the instructions of June, 1916, and later by the "Instructions on the defensive and offensive action of large units," have generally given complete satisfaction. A very clear and very general current of ideas highly favors the fire of a number of batteries on the same targets (i.e., concentration of fire) and enfilade fire. It is necessary to note that, in order to be carried out rapidly, these firings require a careful topographical and technical preparation, and, as far as possible, control of fire by observation. The importance of counter-battery

[1] This system of instruction seeks the same ends as that prescribed for our service—adequate instruction in both the methods of position and of open warfare.

The French teach position warfare first; but we believe that our conditions require that the first lessons of the field artilleryman should be in the war of movement, and that the greater emphasis should be laid on the methods there employed.

The French must first anticipate position warfare, for it should be borne in mind that their tactical and strategic plan of campaign is necessarily based upon their geographical position and frontier system of defence, which, organized as it is upon a chain of strong points, will sooner or later bring about stabilization.

On the other hand, we, with our larger and more thinly populated country, must first anticipate a war of movement, and it would seem logical to teach first those methods for which we expect to have the greatest need.—EDITOR.

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work must be emphasized. In the artillery regulations it should occupy the same important place that it actually occupied at the end of the war. Destruction must be sought when the time and the means are available, but it is indispensable to obtain neutralization for all offensive and defensive operations. The artillery of all the large units must coöperate in counter-battery work, under the direction of the commanding officer of the corps artillery.

Many artillerymen are of the opinion that study should be made with a view to the solution of the following problems:

1. Control by aerial observer of concentrated fire from a number of batteries.

2. Anti-aircraft fire.

3. Fire of smoke and incendiary shells.

They also believe that the defensive barrage should not be retained, but should be replaced by types of counter-preparation determined by the command in its plans for the employment of the artillery.

The offensive barrage remains useful in the form of a box barrage and a rolling barrage, which should closely precede the line of attack. This motion should be introduced in the regulations of all arms.

Demonstration firings, such as "scattered" fire, reply fire, and reprisal fire, must be reduced to a minimum, and regulated by the command in its plans for the use of the artillery or in its operations orders.

To resume, the conduct of fire has only been modified in details during the war—the modifications coming, on the one hand, from the masses of artillery used and the large quantities of ammunition to be expended, and, on the other hand, from the reduced professional ability of battery commanders. The only modifications which have been introduced since 1910 into the regulations particularly concern:

(a) The importance of heavy artillery.

(b) The capital importance of the technical preparation of fire.

(c) The importance of concentration, and the consequent suppression of all the articles relative to the limitation in the use of ammunition.

(d) The importance of controlling fire by aerial observation.

(e) The necessity of neutralizing, before everything else, the hostile artillery in moments of crisis, by using in very strong measures special projectiles, and by firings to neutralize observing stations, P.C's., and telephone centrals.

(f) The importance of fire on armored mobile targets (tanks).

(g) The defense against airplanes and the protection of balloons.

AMMUNITION SUPPLY.

With the exception of ammunition for the aviation and for tanks, the artillery is in charge of the ammunition supply service for all guns, small arms, and automatic arms.

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The ammunition delivered to the armies is distributed by them to delivery centres where it is taken in charge by the army corps which is charged with its transportation to the firing line. For this purpose the army corps uses it own organic means of transportation, and also the transportation belonging to the subordinate units involved.

Within the army corps the Commanding General of the corps artillery is responsible for the ammunition supply for the artillery units located in the zone of the corps, with the exception of the units belonging to the high-power heavy artillery, whose ammunition supply is attended to by the General Artillery Reserve.

Recommendation has been made as regards ammunition supply:

1. To assign the direction of the ammunition supply service in all echelons to the commanding officer of the artillery of that echelon. In the army and in higher echelons this would be a general staff function, however.

2. To place at the disposition of the artillery in each echelon the means of execution properly belonging to that echelon for normal requirements. In case of crisis, when these resources might become insufficient, appeal is made to the commanding officer of the next higher unit for assistance.

3. In order to give the service the maximum flexibility, it is proposed to adopt a system of ammunition supply by separated elements, i.e., projectiles on the one hand, charges and fuses on the other, as well as care in supplying a single lot of powder in the case of charges for the heavy artillery.

CONCLUSIONS.

After the brief review of the developments in artillery tactics during the course of the war, and the subsequent discussion of the present-day artillery doctrine, which has been given in a very superficial way, we can conclude by quoting from an important study made in the French artillery, in which the basic requirements for the artillery in the future are covered in a very broad way.

"What surprises has the next war in store for us? What forms will it take?

"In the face of this great unknown, we must take care to be neither surprised nor disabled. We need for that:

"A service of technical studies, strongly organized, based on a corps of technical specialists belonging to the Army, and completed by a minutely prepared industrial mobilization.

"Regulations without formalism, written in a broad spirit, permitting every initiative.

"Active intelligences, flexible enough to adapt themselves rapidly no matter what form the war takes, or what new devices are produced.

"Finally, and above all, we must not forget that an army is worth more for its morale than for its armament, and that the morale of the troops is only the morale of its leaders. Certainly, the poilu

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was heroic during the five years of war, but all the energy, all the force, all the prestige, and all the authority which was required of the officer with the troops to remedy the many little failures and keep a high morale in the units must be recognized.

"The future army, based on a very short-term service, will depend much more for its value on its cadres than the army of 1914.

"It is thus necessary above everything else to assure this framework, and to prepare the army leaders, the officers and non-commissioned officers, direct leaders of the men in the ranks, in the same way as the leaders of industry, engineers, and shop bosses are prepared.

"To this end, the first condition to be fulfilled is to attract and to retain in the army, men of intelligence, by giving them a situation which is worth while, both morally and materially."

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GAMBLING AND GROUPS.

(Being a sequel to Betting and Brackets).

BY CAPTAIN D. R. D. FISHER, D.S.O., R.F.A.

PART II.

The Proportional Method of deducing the M.P.I.

Our examination of the Five-round Group suggested to us the possibility of establishing a definite relation between the combination of plus and minus observations and the probable distance of the true M.P.I., from the target. If such a method of deducing the position of the true M.P.I., is to be of any practical value, it must satisfy certain conditions :—

(i). Accuracy : the results which it gives must bear comparison with those obtained from actual measurement of the fall of shot.

(ii). Simplicity : the process of deduction must necessitate only the simplest calculations.

(iii). Scope : its style must not be cramped by too many limitations.

(iv). Desirability : it must 'fulfil a long-felt want', as the advertisers say.

Let us consider these points seriatim, beginning with a theoretical examination of the Ten-round Group from the point of view of accuracy.

The Ten-round Group in Theory.

What we want to determine is the degree of accuracy to which the various combinations of pluses and minuses will theoretically permit us to deduce the position of the true M.P.I. with regard to the target, comparing this result with that to be expected from the measured M.P.I. of the group.

The frequency of occurrence of the various combinations of plus and minus rounds in a ten-round group is given by the expansion of $(x + y)^{10}$, where x and y are respectively the 'plus' and 'minus' chances of an individual round on any particular target; and from the Binomial Theorem we know that :—

$$(x+y)^{10} = x^{10} + 10x^9y + 45x^8y^2 + 120x^7y^3 + 210x^6y^4 + 252x^5y^5 + 210x^4y^6 + \text{etc.}$$

The curve illustrating the chance of obtaining any particular combination of pluses and minuses with targets at various points in the 100% zone of the gun is given by the appropriate term of this expansion; e.g. that for 6 pluses and 4 minuses is given by $210x^6y^4$, and that for 4 pluses and 6 minuses by $210x^4y^6$. As however $(x + y) = 1$, since every round must be either plus or minus, it follows that the curves of $210x^6y^4$ and $210x^4y^6$ will be equal and opposite; and it is

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moreover obvious that when there are more pluses than minuses the true M.P.I. is probably plus, and vice versa. One curve will therefore satisfy our curiosity about both combinations of pluses and minuses, i.e. 6 and 4 or 4 and 6, and for the sake of simplicity we will call it the curve of the combination 6/4 without specifying which is which.

The curves of all combinations from 5/5 to 9/1 are reproduced in Figs. III (a) to (e), and are treated similarly to those of the Five-Round Group (Fig. II (a) and (b), Part I.) The target is in each case assumed to lie at the point of maximum chance, i.e. at that distance from the true M.P.I. which gives the combination in question its maximum chance of occurrence, and by an adjustment of areas the Probable Error involved in this assumption is determined. The results are as follows :—

TABLE A. THE TEN ROUND GROUP.

COMBINATION.	5/5	6/4	7/3	8/2	9/1
Max: Chance (T_1, etc.) ...	·246	·252	·271	·300	·392
Distance between T_1, etc. and true M.P.I. (O) ...	Nil.	·20F	·40F	·65F	·95F*
P.E. involved in assuming target at T_1, etc.	·20F	·20F	·20F	·22F	·27F

Average P.E. of all five combinations, ·22F.

Average P.E. excluding 9/1, ·20F.

* Taken as 1·00F for convenience: see Fig. III (e).

These results show us that the Probable Error involved in assuming the target to lie at the point of maximum chance (T_1, T_2, etc.) of the combination is approximately constant up to and including the combination 8/2 but rises appreciably with the combination 9/1, which we will therefore exclude as unreliable. Here is our first hint of a limiting condition, that satisfactory results are not to be counted on from a combination in which less than 20% of the rounds are either plus or minus: with this reservation, the average P.E. involved in the foregoing assumption is ·20F. But we know that the P.E. of the measured M.P.I. of a group of 10 rounds, as compared with the true M.P.I. is $\frac{\cdot 5F}{\sqrt{10}}$ or ·16F: the extra P.E. involved in deducing the M.P.I. instead of measuring it is therefore ·20F − ·16F = ·04F, or one twenty-fifth of the 50% zone.

What exactly does this mean? Not only that an uneven combination of pluses and minuses up to and including 8/2 is in its way as useful as the ideal 5/5, but also that any one of these combinations may be persuaded to disclose information almost as reliable as that given by an accurately measured M.P.I.; in fact—or at least in

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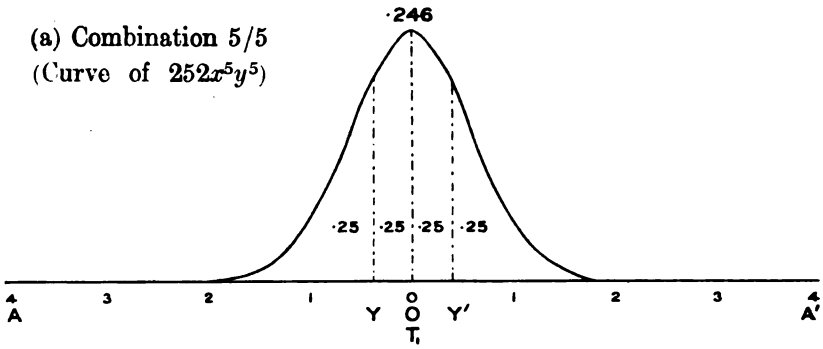
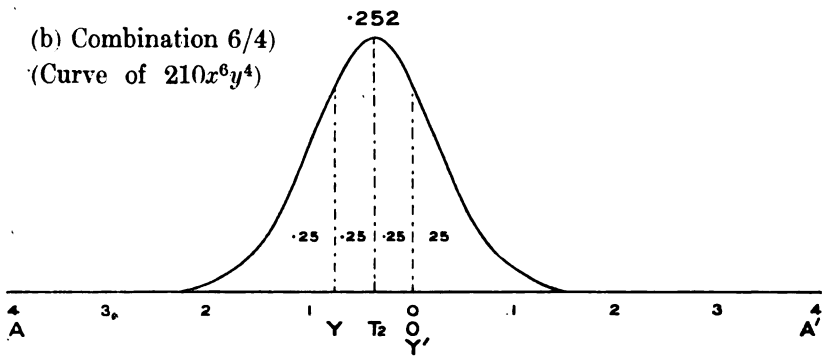
Fig. III. The Ten-Round Group.

(a) Combination 5/5
(Curve of $252x^5y^5$)



(b) Combination 6/4)
(Curve of $210x^6y^4$)



(c) Combination 7/3.
(Curve of $120x^7y^3$)

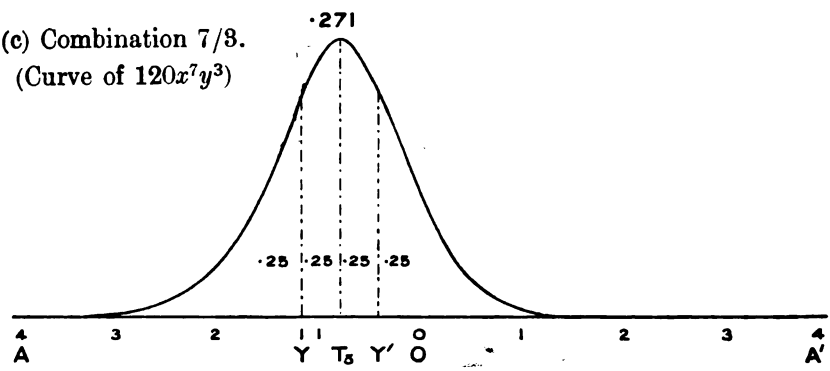


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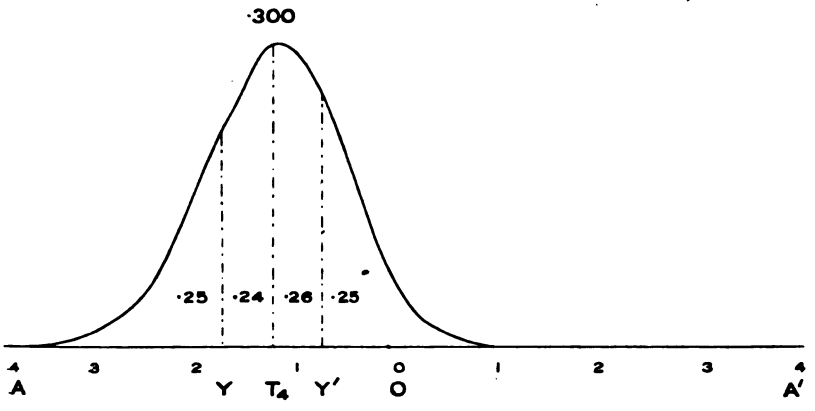
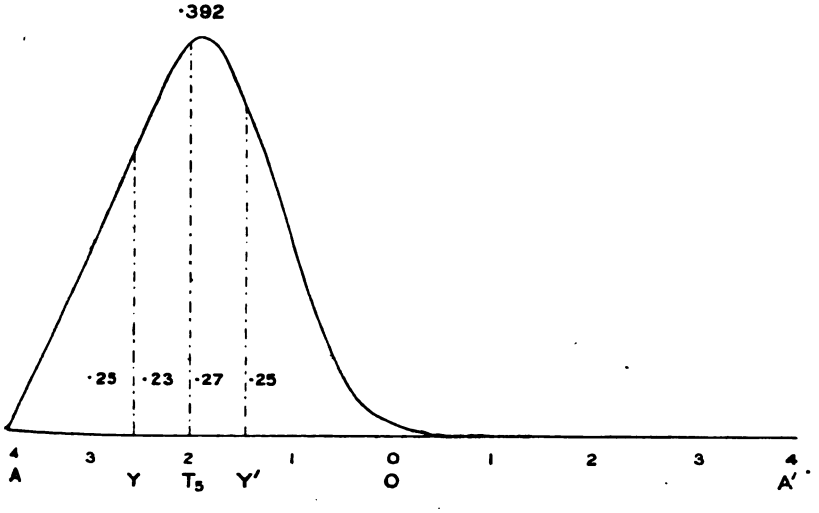
Fig. III. The Ten-Round Group,

(d) Combination 8/2. (Curve of $45x^8y^2$)



(e) Combination 9/1. (Curve of $10x^9y$)



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theory— the probable extra accuracy gained by going out with a tape, measuring the distance of each shell-hole from the target and calculating the M.P.I. of a ten-round group, instead of being content with deducing it from the combination of pluses and minuses, is with any ordinary cannon well under 5 yards. Let us see how this fine fabric of theory comes out in the wash.

The Twelve-round Group in Practice.

The main reason for selecting a group of this size was that it appeared not unlikely that a twelve-round group in practice would attain about the same standard of accuracy as a ten-round group in theory, an idea that proved reasonably sound. In all some 600 of these groups were examined, fired for divers experimental purposes by different natures of gun (9·2-inch, 6-inch and 4·5-inch howitzers and 60 and 18-pounder guns) and accurately taped. The investigation was carried out in two distinct stages.

(a) To compare the Mean Errors of the Measured and Deduced M.P.I's with regard to the true M.P.I.

To do this practically it is naturally necessary to obtain the true M.P.I., but the sad fact is that this, like other abstract truths, exists only in the realms of theory and finds no place in everyday life. The more rounds you fire, the nearer you approach it—but only up to a point; if you go on too long the wind changes, the gun begins to wear and the layer to grow weary: in other words your external conditions alter, and just as it appears to be within your grasp the truth eludes you as it eluded Quetelet, whose statistics of infantile mortality were spread over so many years that the pitch of his curves was eventually queered by the popularization of an improved brand of pap.

'What is truth?' asked jesting Pilate: for our present purpose it is the measured M.P.I. of 100 rounds.

To carry out this test therefore two groups of 100 rounds were taken, the M.P.I. of each being adjusted to ± 0, and each group was split up into 89 groups of 12 consecutive rounds (1 - 12, 2 - 13, etc.), the Measured and Deduced M.P.I's of which were tabulated. Large masses of figures make dull reading and we will confine ourselves to a digest of the results (Table B), deferring for the moment the very necessary explanation of how the Deduced M.P.I's were arrived at.

Table B shows that when we include only those combinations which contain not less than 20% of either pluses or minuses, the extra Mean Error involved in deducing the M.P.I. instead of measuring it is ·04F, or one twenty-fifth of the 50% zone. Now, not only is this extra M.E. so small as to be negligible, but it is also in striking agreement with the corresponding extra P.E. (·04F) which our theoretical examination of the ten-round group led us to expect; and the Mean and Probable Errors, though not theoretically identical, are so closely allied (M.E. $\times$ 1·69 = P.E. $\times$ 2) that this similarity of result may fairly be taken as a practical confirmation of our theoretical conclusion; namely that there is no appreciable loss of accuracy in accepting the Deduced instead of the Measured M.P.I. of a group of 10 or 12 rounds, provided only that not less than 20% of the rounds are either plus or minus.

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TABLE B. THE TWELVE ROUND GROUP.

Group of 100 Rounds fired by:—

	9·2″ Howr. Mk. 1.	60 pr. Mk. 1.
Charge	Fourth	Full
Elevation	26°	6500ˣ
50% zone, Range Table*	80ˣ	48ˣ
50% zone, developed	79ˣ	60ˣ
M.P.I. (assumed true)	±0	±0

* R.T. 50% zone used for deducing M.P.I's of groups.

	Mean Error of M.P.I. of groups of 12 rounds.		
	(a) Measured.	(b) Deduced.	(c) Deduced up to 9/3
9·2″	21ˣ = ·26F	34ˣ = ·41F	27ˣ = ·34F
60 pr.	13ˣ = ·27F	14ˣ = ·29F	13ˣ = ·27F
Mean	·27F	·35F	·31F

Difference in favour of (a) over (c), ·04F.

(b) To find the Mean Difference between the Measured and Deduced M.P.I's of groups of 12 rounds.

We have shown both theoretically and practically that while neither Measured nor Deduced M.P.I. is likely to agree with the True M.P.I., they have approximately the same Probable Error with regard to it and are in consequence equally reliable; but we are all of us more prone to believe what we actually measure than what we merely calculate, and we would naturally regard with suspicion a system of deduction the results of which differed materially from those obtained by measurement, no matter how untrustworthy that measurement might theoretically be. We have so seldom the opportunity of seeing sufficient rounds fired at the same elevation to establish anything like a true M.P.I. that we are apt to accept the actual M.P.I. of any small group as gospel, and to reject with contumely any suggestion to the contrary. The object in determining the mean difference between the Deduced and Measured M.P.I's is indeed rather moral than mathematical, since any great discrepancy between them, however easy it might be to explain away in theory, would inevitably cause considerable alarm and despondency in practice.

In order to lay this spectre of distrust, over 600 groups of 12 rounds were examined and the two species of M.P.I. compared. The mean difference between them proved to be under ·1F, i.e. less than one tenth of the 50% zone; a greater difference than ·3F seldom occurred; and no difference of as much as ·5F was encountered: a result that may fairly be regarded as satisfactory.

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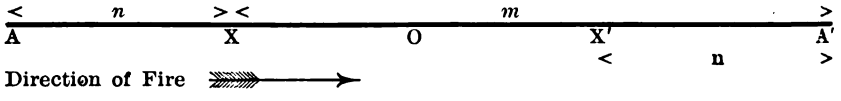
The Method of Deduction.

We are now, let us hope, satisfied that reasonably accurate information about the true M.P.I. can be extracted from an uneven combination of pluses and minuses, but so far no attempt has been made to render that information readily available. What we require is some simple method of connecting any combination of pluses and minuses with the corresponding probable distance of the true M.P.I. from the target; i.e. of deducing what we have called the point of maximum chance of the combination. Let us tackle the question graphically.

FIG. IV.



Suppose a group of $(m + n)$ rounds to have given m pluses and n minuses: this combination will obviously be most likely to occur when the target is at such a point in the 100% zone that each individual round has m chances of being plus as against n of being minus; i.e. at such a point that plus and minus rounds will in the limit occur in the proportion of m to n. Let us take the case where there are more plus than minus rounds, i.e. where $m > n$ and where in consequence the true M.P.I. is probably plus of the target.

In Fig. IV let AA′ be the 100% zone of the gun, O the true M.P.I. and X the target at such a point that XA′ will theoretically contain m rounds (plus) as against n rounds (minus) contained in AX.

Insert a point X′ such that X′A′ = AX; then as AX contains n rounds, X′A′ also contains n rounds, since the zone is theoretically symmetrical.

But if XA′ contains m rounds and X′A′ n rounds, XX′ must contain the balance, i.e. $(m - n)$.

That is, XX′ contains $(m - n)$ rounds out of a total of $(m + n)$; in other words, XX′ is the $\left(\frac{m - n}{m + n} \times 100\right)$ % zone of the gun; and since the pattern is symmetrical, $XO = OX' = \frac{1}{2}XX'$.

But O is the true M.P.I. and X the target; hence the distance between them is $\frac{1}{2}\left(\frac{m - n}{m + n} \times 100\right)$ % zone.

We have now achieved an expression connecting the combination of pluses and minuses with the probable position of the true M.P.I.—and a very forbidding expression it is; but before we try to simplify it let us test it against one of our curves. Consider the combination 7/3, Fig. III (c), and suppose we have 3 pluses and 7 minuses. Substituting these values of m and n in our expression we see that the required distance is $\frac{1}{2}\left(\frac{3 - 7}{3 + 7} \times 100\right)$ % zone.

$$= \frac{1}{2}\left(\frac{-4}{10} \times 100\right) \% \text{ zone.}$$

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$= -\ \frac{1}{2}$ the 40% zone,

$= -\ \frac{\cdot 78F}{2}$ (from the Probability Factors),

$= -\ \cdot 39F$; i.e. the true M.P.I. is ·39F short of the target, as compared with the ·40F given by Fig. III (c)—a minute discrepancy easily accounted for by the difficulties of curve-drawing.

Our expression is therefore quite satisfactory as regards accuracy —it even goes so far as to tell us by its sign on which side of the target the true M.P.I. lies, a quite unnecessary item of information; but its best friend could not claim that it is either simple or attractive. Let us see whether we cannot eliminate percentages and Probability Factors and the calculations which they entail.

Earlier in the proceedings we decided to include no combination more uneven than 8/2, where 20% of the rounds are either plus or minus and where the probable distance of the true M.P.I. from the target is in consequence half the 60% zone; let us therefore examine the various zones up to this limit.

TABLE C. ZONES AND THEIR FACTORS.

Zone.	Probability Factor *	½ zone in terms of F.	
		(a) Accurately.	(b) Approximatley.
10%	·18	·09F	·1F
20%	·38	·19F	·2F
30%	·57	·29F	·3F
40%	·78	·39F	·4F
50%	1·00	·50F	·5F
60%	1·25	·62F	·6F

A comparison of the first and last columns shows that half the 10% zone is approximately ·1F, or $\frac{10F}{100}$, and so on up to the 60% zone. Hence half the x% zone is $\frac{xF}{100}$ and half the $\left(\frac{m-n}{m+n} \times 100\right)$% zone is $\left(\frac{m-n}{m+n} \times 100\right) \times \frac{F}{100}$ or $\left(\frac{m-n}{m+n}\right) \times F$: in other words, where a group of $(m+n)$ rounds has given m pluses and n minuses, the probable distance of the true M.P.I. from the target is $\left(\frac{m-n}{m+n}\right)F$; let us test it.

* Illustrating the approximately even distribution of rounds in the 60% zone, a property to which we shall refer later on.

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Suppose as before that our group of 10 rounds has given 3 pluses and 7 minuses; what is the probable position of the true M.P.I. with regard to the target? Substituting 3 and 7 for m and n in our new expression we get :—

$$\left(\frac{3-7}{3+7}\right) F = \frac{-4F}{10} = -\cdot 4F;$$

i.e. the true M.P.I. is ·4F short of the target. We have in fact achieved substantially the same result as before (·39F), but this time without consulting the Probability Factors and with very considerably less calculation. But simple as our expression now is, it may be still further simplified; we know instinctively that if there are more pluses than minuses the true M.P.I. is probably plus, and vice versa; consequently there is no need to introduce the question of signs into an expression which is really required to tell us merely the distance between the target and the true M.P.I. The method of deducing this distance may be epitomized thus[1] :—

(a) Subtract the plus from the minus rounds, or vice versa, whichever is the less. $(m - n)$.

(b) Divide this difference by the total number of rounds in the group. $\left(\frac{m-n}{m+n}\right)$

(c) Multiply the result by the Range Table 50% zone in yards or corresponding minutes of elevation, as may be required. $\left(\frac{m-n}{m+n}\right) .F$

We have now satisfied two of our original four conditions; we have shown both theoretically and practically that the method is reasonably accurate, and we have evolved a simple process of deduction.

It remains for us to determine its limitations and to suggest the purposes for which it may be usefully employed.

The Limitations of the Method.

The only essential condition which our theoretical and practical examination of the accuracy of the method has so far suggested is that not less than 20%, i.e. one fifth of the rounds must be either plus or minus; but it is a well-known axiom of ranging that the whole value of a series should not depend on the observation of a single round, and this at once suggests another limitation, namely that not less than 2 rounds must be either plus or minus. Let us see how these two conditions govern the size of the smallest group to which the method can strictly be applied.

A four-round group has already been tried and found wanting on other grounds, and we have agreed to accept the 3/2 combination of a five-round group as indicating that the target and the true M.P.I. probably coincide; the 4/1 combination of 5 rounds fails through con-

[1] It was by this method that the M.P.I's of the various twelve-round groups were deduced (Table B, etc.).

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taining only one plus (or minus), and a six-round group suffers from the same disabilities as one of 4 rounds—in fact all small even-number groups are tarred with the same brush. A seven-round group however gives us one workable combination; we should naturally accept 4/3 as indicating that the elevation is probably correct, but 5/2 shows us that the probable distance of the true M.P.I. from the target is $\left(\frac{5-2}{5+2}\right).F = \frac{3F}{7}$, say half the 50% zone.

Larger groups will obviously give us a higher proportion of workable combinations, and moreover the larger the group the smaller is the Probable Error of the Deduced with regard to the True M.P.I.; hence the only limitation of the method in this respect is that it cannot comfortably be applied to a group of less than 7 rounds.

A final consideration, which is in fact rather a condition of application than a limitation of employment, cannot fail to have occurred to the most casual reader. What is to be done with the round that has tactlessly achieved the theoretically impossible—that has hit the target? Targets in real life are happily not 'mathematical points immune from direct hits', and it is a pleasant paradox that the phenomenon most ardently desired in practice should be utterly discountenanced in theory; nevertheless it is to theory that we must look in the first instance for a solution of this conundrum. Suppose we are shooting at a house; our outward and visible target is the house itself, but our inward and theoretical target is the mathematical centre of the house, whatever and wherever that may be. Now suppose we hit the house; we proudly write down T in our observations and metaphorically pat ourselves on the back—but we cannot pat our theoretical target on the back, metaphorically or otherwise: it is axiomatically unpattable and unhittable and unattainable, and we have not the smallest notion whether what we recorded as a hit on our actual target the house was a plus or a minus on our mathematical point. It must however have been either the one or the other, and the fairest solution seems to be to count it as *both;* i.e. a round which is observed as Target is taken for purposes of deduction as giving two observations, plus and minus. This procedure has been found to give very satisfactory results in practice; indeed when a round has obviously fallen close to the target and it is impossible owing to difficulties of observation or to a slight error in line to tell definitely whether it was plus or minus, it is much sounder to write it down as both than to accept the only alternative—to ignore it altogether. The adoption of this convention has the incidental effect of slightly enlarging the scope of the method, as will presently appear.

The Method in a Nutshell.

Let us endeavour to crystallize our conclusions into a few brief phrases and a typical example :—

Working Rule. The true M.P.I. of a group of 7 or more rounds fired at the same elevation may under certain conditions be deduced to a high degree of accuracy.

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These conditions are :—

(a) Not less than one-fifth of the group must be either plus or minus, and

(b) Not less than 2 rounds must be either plus or minus, but

(c) A round observed as Target counts as both plus and minus, i.e. as 2 rounds.

The method of deduction is :—

(a) Subtract the number of plus from the number of minus rounds, or vice versa, whichever is the less. $(m - n)$

(b) Divide this difference by the total number of rounds and multiply by the Range Table 50% zone in yards (or in equivalent minutes of elevation). $\left(\frac{m-n}{m+n}\right).F$

(c) The answer is the distance in yards (or in minutes of elevation) of the true M.P.I. from the target. If there are more plus than minus rounds the M.P.I. is plus, and vice versa.

Example. A group of 7 rounds gives 1 plus, 5 minuses and 1 Target, which is taken as being equivalent to a plus and a minus (Condition (c)). Consequently we have 2 pluses and 6 minuses for purposes of deduction, and conditions (a) and (b) are therefore satisfied.

(i) Suppose the R.T. 50% zone to be 80 yards : the required distance is $\left(\frac{6-2}{6+2}\right).F = \frac{4F}{8} = \frac{F}{2} = 40$ yards ; and there are more minuses than pluses, therefore the true M.P.I. is 40 yards short of the target.

(ii) Suppose the R.T. 50% zone to correspond to 25′ of elevation : there are more minuses than pluses, therefore to bring the true M.P.I. on to the target the elevation must be increased by $\frac{(6-2)F}{8} = \frac{F}{2} = \frac{25}{2} = 10'$ or $15'$.

Practical Uses of the Proportional Method.

The common end of the two recognised systems of ranging for elevation—Bracketing and Grouping— is Information, whether for its own sake (Datum and Witness Points, Calibration) or as a prelude to effective fire ; nor is this thirst for information quenched when method of fire is reached, for in any deliberate observed shoot the performance of each gun will be scrutinized for indications that its elevation should be modified. Let us see how far the Proportional Method will assist us to attain this end, starting with the consideration of the ordinary process of bracketing, a process that as a rule presupposes at best a slender knowledge of the exact position of the target.

When a verified short bracket has been obtained on a target which demands a high degree of accuracy, the normal procedure is to fire groups of rounds, either at 'all guns ranging' or at battery fire, with the object of finding an elevation that gives as nearly as possible an equal number of plus and minus rounds, and it is usual to start with a five-round group at the intermediate elevation of the short bracket. If this first group gives 2 pluses and 3 minuses, or vice versa, well and good ; but suppose it gives 4 pluses and 1 minus, or 5 pluses— what then? The combination 4/1 shows that the M.P.I. is

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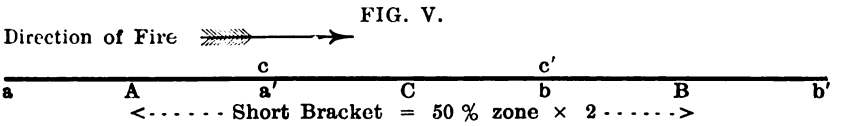
$\left(\frac{4-1}{4+1}\right)^{.F} = \frac{3F}{5}$ or rather more than half the 50% zone plus of the target, but it does not satisfy one of the essential conditions of the method (containing as it does only 1 minus round) and we would therefore not be justified in altering the elevation by so small an amount. We may however accept 4/1, and still more 5/0,[1] as an indication that the target lies outside the 50% zone of the gun. Let us examine this state of affairs graphically (Fig. V.).

FIG. V.



In Fig. V, A and B represent the true M.P.I. at the bottom and top ends respectively of the short bracket, and C that at the intermediate elevation: the three 50% zones, aa′, cc′, bb′, will be seen to lie end-for-end. Either 4 pluses and 1 minus or 5 pluses at the intermediate elevation suggest that the target lies minus of C and outside the 50% zone cc′; but the two minuses which formed the bottom end of the short bracket make it unlikely that the target is far minus of a′, i.e. of c. Hence the most probable position of the target is somewhere between a and a′, i.e. inside the 50% zone of the gun at the bottom end of the short bracket; and when it is borne in mind that the rounds inside the 60% zone of the gun are approximately evenly distributed (vide Table C and footnote) and that consequently as long as the target lies somewhere inside the 50% zone it does not much matter whether it is at the centre of it or not, it will be seen that the most logical as well as the most economical procedure is to fire 3 rounds at the bottom end of the short bracket and thus obtain another five-round group. This five-round group at elevation A starts with the 2 minuses of the verified short bracket, and the 3 extra rounds can therefore only indicate either that the elevation is correct (3 pluses or 2 pluses and a minus, making 2/3 or 3/2) or that it is too short (3 minuses or 2 minuses and a plus, making 5/0 or 4/1); in the former case all is well and in the latter an elevation midway between A (too short) and C (too long) is indicated, i.e. the elevation should be increased by an amount corresponding to half the 50% zone, that is by a quarter of the short bracket. The number of rounds fired at the elevation finally selected must of course depend on the object of the shoot and on the degree of accuracy required.

There is at present no definite procedure laid down to be carried out when greater accuracy that that given by a verified short bracket is demanded, and the foregoing application of the Proportional Method has at least the advantage of being definite and simple; let us epitomize it :—

(a) Fire a group of 5 (or 4)[2] rounds at the intermediate elevation.

[1] In practice one would probably be content with 4/0, i.e., not fire the fifth round, if communications allowed one to stop it.

[2] When ammunition is more valuable than time, it is not necessary to fire 5 rounds at a blow, since 4 rounds may give all the information required; i.e., 4/0 and 2/2 are decisive, 3/1 must be completed to 5 rounds to see whether it becomes 3/2 or 4/1.

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(b) If this group gives 3/2 (or 2/2), accept the elevation as correct and use the Proportional Method to indicate whether any subsequent alteration is desirable.

(c) If this group gives 5/0 or 4/1 (or 4/0) complete the appropriate end of the short bracket to 5 (or 4) rounds, and on the result of the completed group either continue at that elevation or split the difference between it and that of the previous group, i.e. the intermediate elevation.

So much for the refinements of Bracketing, in which the Proportional Method has perhaps been of indirect rather than of direct value. When however we come to fire for effect its assistance is more obviously available, since it enables us to extract the M.P.I. of a number of rounds and to deduce by how much, if at all, the elevation of the gun should be altered. In this connection it is important to remember that the rounds in the 50% zone are almost exactly evenly distributed, that minute alterations in elevation are in consequence seldom worth making, and that guns, like the rest of us, get along much better if they are not constantly interfered with but are left alone to show what they can do. Here again the Proportional Method has an indirect as well as a direct value; it necessitates 7 or more rounds at the same elevation and that gives the gun a chance to settle down steadily to its job.

But it is in shooting for information pure and simple—and accurate—that the Method really comes into its own. All that is required in the case of a Witness or Datum Point or in Calibration is to determine the position of the M.P.I. and thus deduce the correct elevation to the target, and this is the very purpose for which the Proportional Method was evolved. By its use the expenditure of time and ammunition involved in endeavouring to find an elevation that will give an equal number of pluses and minuses is considerably reduced, the errors and approximations of the Elevation Factor are avoided, and the elaborate arrangements necessitated by cross-observation are dispensed with; and though cross-observation has undoubtedly the advantage of giving the line as well as the range, against this must be set the fact that the slope of the ground on which the target stands may introduce considerable complications when the fall of shot is measured but can be of no possible consequence when the M.P.I. is deduced. Moreover, with the admittedly important proviso that the line must be more or less correct, the Proportional Method enables the M.P.I. to be obtained from any observing station situated anywhere with reference to battery and target—even from an aeroplane or a balloon—and under any conditions of observation which allow a minus round to be distinguished from a plus.

There is perhaps a danger that the complacent catalogue of the virtues of the Proportional Method in which our study of Brackets and Groups has culminated may be taken to imply a suggestion that it might supersede certain existing methods of ranging and observation, but such is by no means the case: it is however hoped that its accuracy, its simplicity, its scope and the versatility of its application may render it a useful arrow in the quiver of the Battery Commander.

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SOME CONSIDERATIONS WHICH AFFECT THE PRESENT RECRUITING PROBLEM FOR THE ROYAL ARTILLERY.

By Lieut. J. D. Taylor, M.C., R.F.A.

RECENTLY the War Office has been showing some concern over the fact that most of the men whose extended duration service expired on the 1st April were in no way keen to take on for normal engagements with the colours. No inducement seemed to appeal to them, and when pressed for a reason the explanations they gave in many cases failed to explain. It is only through talking to the men individually in a casual, informal way, and with their non-commissioned officers, that one really gets to the bottom of the matter, although most section commanders in touch with their own units could make a pretty shrewd guess.

The Gunners as a regiment are said to be among the most reluctant, but that is not altogether surprising. Those who are conversant with the actual state of affairs realize that the Royal Artillery is not popular to-day, and the reasons may be listed under the following headings :—

1. Hard work.
2. Attractions of civil life.
3. The new educational scheme.
4. Pay grievances.

Let us consider each of these in detail.

Hard Work.

Compared to the labourer in civil life, and compared to the soldier in the infantry and other branches, the Gunner's life is an arduous one. In many trades a day's work seems to be measured by what an average man can accomplish when he is feeling tired; and the British workman of the present time can well afford to laugh at the poor gunner or driver whose day begins at 6 a.m. and ends with water and feed at 7 p.m., provided he is not on guard or picquet for the night. The foot soldier to-day (no longer "P.B.I.") enjoys his afternoon's sport and his frequent half holidays untrammeled by care; not so the artilleryman, whose whole routine of life is conditioned by the care of horses, a hardship which is increased at most home stations by the prevailing shortage of personnel, although the horse strength is kept up to establishment. Remounts have provided the horses, but no one has yet found the men. Thus, the slackness in recruiting tends to perpetuate itself by aggravating the very evil which full recruiting would alleviate.

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Unemployment used to help recruiting, but that was before government doles became the fashion. Higher pay used to attract men to the artillery, and compensate for harder work; to-day the Gunner draws the same pay as the Infantryman and works harder for it.

Day in and day out, through fair weather and foul, the artilleryman has his horses to water, feed, groom, exercise, clip, singe, rug up and bed down, and his harness to clean, and in the short days of winter this leaves a small margin of time for other things. Yet the unfortunate battery commander is expected to carry out the prescribed programme of individual training and on top of that he is continually bombarded with instructions from all quarters from people with various hobbies, all excellent in their way, but most annoying when they take the form of demanding officers, N.C.O's. and men for "courses" in every conceivable subject under the sun; while the battery sergeant-major is already at his wits' end to find the men required for various employments and still leave a residue of "duty" men sufficient to keep the horses and harness in decent condition.

When sub-sections parade at stable hour with three men and a boy, each required to do two men's work, it is not surprising that enthusiasm for soldiering is likely to wane.

Attractions of Civil Life.

In contrast to the very real and present hardships of soldiering, the man sees or imagines in civil life a life of ease and comfort. Even though he has no job to go to and perhaps has never saved a penny from his army pay, unemployment holds no immediate terrors for him; he can draw the government grant of fifteen shillings a week for fifteen weeks. At the end of that time, if he comes to the end of his tether, he can always enlist in an infantry regiment,—an Irish one for choice,—where his late pals in the artillery will "reckon he's laughing." But, come what may, a great many men are determined to try their luck in civil life and enjoy a few months' holiday at the least before they will think of soldiering again.

Education.

The new educational scheme undoubtedly tends to discourage men who might otherwise think of taking on. They find that the regulations compel them to obtain a second-class certificate of education before receiving proficiency pay. Many of them have already been drawing this extra pay for two or three years, but on re-engaging for "six and six" they forfeit this and can only get it back by going to school and passing examinations. The idea of compulsory attendance at school is always distasteful, particularly so to men who have a hard day's work without it, and who consequently look upon it as a device to rob them of the little spare time they might otherwise have to themselves.

A man may be an excellent driver or gunner and yet fail to attain the standard necessary for a second class certificate under the new regulations. Even though his battery commander is ready and willing to classify the man as proficient in his regimental duties, the

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real decision rests with the schoolmaster, who will also have a large voice in determining promotions to warrant rank.

Pay Grievances.

Various petty grievances about pay undoubtedly exist. Sometimes it is the man's own fault, sometimes his pay sergeant's, sometimes the Paymaster's department. The latter, of course, is always right in the end, but the existing tangle of complicated and sometimes contradictory instructions makes for all sorts of errors, some of which are not adjusted for a long time. In one battery, for example, half a dozen men have recently been made to forfeit a whole year's proficiency pay, some of them on the eve of being discharged. Having drawn the pay all this time they naturally assumed that they were entitled to it, and the pay sergeant has credited it to them in good faith,—only to be informed after a lapse of twelve months that it must now be deducted from the man's account, an item of nine or ten pounds.

These things are talked about in the barrack rooms and the men lose confidence in their officers and in the army. They feel that in matters of pay they can never be certain where they stand, and although most of their suspicion is unjustified by facts, it exists all the same, and can not help but influence those who are urged to continue in the service.

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INFANTRY GUNS.

By Major (Bt. Lt.-Col) G. P. MacClellan, D.S.O., R.A.

PERHAPS a few very short remarks on some of the statements made in the article with the above title which appears in the February number of the Journal may be permitted; that others are not touched upon is not as a rule because they are considered to be unanswerable, but it is merely to avoid length.

1. The author of the article in question compares an "ideal gun" on wheels, which is to be built solely for the work of an Infantry Gun, with the existing pack artillery equipments which have been designed for general use, much to the disadvantage of the latter: surely this is no fair comparison. Nobody suggests that a Pack Battery organised to act as Field Artillery over ground like the N.W. Frontier of India is the best form of Pack Artillery for the rôle of Infantry Guns.

2. Again, he says "Surely it is equally self evident that Pack Artillery cannot move so fast with their detachments as guns on wheels with limbers for the detachments to ride on." So far from admitting this to be a self evident fact I deny that it is a fact at all; it depends on the ground and on the obstacles encountered in moving over it. Experience with both wheels and pack has convinced me that across normal country pack is on an average at least as fast as wheels.

3. The ability of the Pack Gun as compared with the gun on wheels to take advantage of cover when on the move across country is almost ignored in the article in question. This advantage, surely a not unimportant one at close range, is as indisputable as is the fact that infantry extended can make better use of the cover usually met with when working across country than can infantry in quarter column.

4. Quoting once more from the article, when dealing with draught—"if the gun can get to the desired spot" certain advantages follow. Precisely—if. It is half the case of the advocate of pack that that "if" is a very big one.

A great deal is made in the article in question of the serious consequences which ensue in pack in the event of any mule becoming a casualty. Anybody with any experience of Pack Artillery knows that this disability exists largely because the question has never been officially seriously tackled; and that the introduction of cradles designed for more than one load, a by no means difficult proposition, would go far towards defeating it.

As regards the opinion expressed in the note placed at the head of my original article that it was "out of date" a perusal of Section 12, paras 5 (a) and 6 (a) of Field Service Regulations Part II. 1920 (just received in this part of the world) leads me to suppose that I sin in good company.

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

The Journal of the U.S. Artillery—April, 1921.

Self-Propelled Artillery.

The Design of War Vessels as affected by The World War.

The Field Artillery Journal—March—April, 1921.

The Drama of the Marne. (July 15. 1918). By Kurt Hesse, (German Officer).

Fire Discipline. Major C. Wallace.

Belgium.

Bulletin belge des Sciences Militaires—May, 1921.

I. Operations of the Belgian Army, 1914-1918. (Continued).
II. Gas Warfare. (Continued.) Dr. Sillevaerts.
III. Belgian Strategic Railways during the war. (Continued). Maj. Denis.
IV. Accuracy and quickness in engaging moving targets. Lt.-Col. Grade.
V. French provisional instructions for Infantry machine-gun units.
VI. Aviation. Air transport.
VII. Notes on Foreign Armies.

France.

Revue Militaire Générale—March, 1921.

I. The evolution of doctrine and regulations before the war, and the technical value of our Infantry.
The war and its consequences. Lt.-Col. P. A. Cour.
(The Editor draws attention to articles by Lucius in Nov. 1920, Jan.—Feb. 1921 on this subject but from a different point of view.)
II. The German Naval High Command. Edmond Delage.
III. French Cavalry on the Eastern Front. Capt. R. Cross.

Revue d'Artillerie—April, 1921.

I. The effort of the French metal working trade during the war. M. Robert Pinot.
II. The Thompson automatic pistol. Lt. Jean.
III. Fire Tactics (continued). Col. Cambuzat.
IV. Note on curvilinear recoil. Capt. Olive.
V. German and Austrian high power guns. (Continued).
VI. Organisation of the post-war German Artillery.
Consists of: 7 Inf. Divisional Artilleries.
3 Cav. Divisional Artilleries.

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Infantry Div. Arties. 3 groups of 3 4-gun batteries, plus a depôt battery.
Each group has 1 battery of four guns.
1 battery of four howitzers.
The third battery of the group is specialised.
In the first group it has 4 infantry guns.
In the 2nd group it has 4 Field Guns but also undertakes the sound ranging, meteorology, survey, etc.
In the 3rd group 4 anti-tank guns—composed of A.A. guns.

Cavalry Div. Arties. Each Division has a group of Horse Artillery of 3 4-gun batteries.

Italy.

Rivista di Artiglieria e Genio—Feb.—March, 1921.

The artillery of the XXX Corps in the Battle of 24—31 Oct. 1918.

Switzerland.

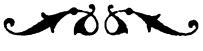
Revue Militaire Suisse—April, 1921.

I. The evolution of Offensive Actions. Lt.-Col. H. Corda.
II. Strategic Switzerland in the League of Nations. (Contd.) Col. Feyler.
III. Range-finding instruments. Capt. Hausammann.
IV. Foreign Notes.
Distribution and Strength of the French Army in the different theatres.—The Colonial Army.—Its future use.

Spain.

Memorial de Artilleria—April, 1921.

Guns of Accompaniment. (Continued).



CORRIGENDA.

Part II, page 8, April "Journal" Resignations:

Hadow, Lieut. K. C., M.C., 8th March, 1921, *add* "with rank of Major."

Part II, page 15, May "Journal" Staff Appointments, etc:

Hume, Lieut. D. V., from A.-D.-C. to Inter Allied Comm. Austria 31/2/21 *should read* Hume, Lieut. R. V., Officer attached to H.M. Embassy, Berlin.

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REGIMENTAL LIST. The following Postings have occurred during the period 16th April, to 15th May, 1921.

Postings.—R.H. and R.F.A.

16/3/1921.

Studdert, Capt. (Bt. Maj.) R. H., D.S.O., M.C., from Staff, to Unposted.

17/4/1921.

Harmer, Lieut. F. L., from 37th Batty. R.F.A., Nowshera, India, to 27th Bde. Ammn. Col.

Holmes, Lieut. L. G., from 23rd Batty. R.F.A., Aldershot to "C" Batty. R.H.A., Meerut. (On Appointment).

20/4/1921.

Holmes, Lieut. G., M.C., from att. Gold Coast Regt., W.A.F.F., to 23rd Batty., R.F.A., Aldershot.

Twistleton-Wykeham-Fiennes, N. I. E., D.S.O., from Medical Board Leave to 78th Batty. R.F.A., Norwich.

21/4/1921.

Doddie, Capt. E. T., from 21st Bde. R.F.A., Meerut, to 59th Batty. R.F.A., Kirkee.

Martin, Capt. G. N. C., D.S.O., M.C., from 23rd B.A.C. R.F.A., India, to 32nd Bde. R.F.A., Hyderabad Sind.

Robinson, Capt. W. H., from 18th Bde. R.F.A., Kirkee, to R.A. Depôt, Deesa, India.

Williamson, Lieut. J. R., from 27th B.A.C., R.F.A., India, to 121st Batty. R.F.A., Peshawar.

23/4/1921.

Dunbar, Major J. C., D.S.O., from 36th Batty. R.F.A., Dundalk, to II. Res. Bde., R.F.A., Preston.

Halliday, Major W. J. F., D.S.O., from D.A.D. Remounts, Egypt, to 27th Bde., R.F.A., Nowshera.

Hovil, Major R., D.S.O., from II. Res. Bde., R.F.A., Preston, to 36th Batty., R.F.A., Dundalk.

Jones, Lt.-Col. E. H., D.S.O., from 20th Bde. R.F.A., Bangalore, to V. Res. Bde., R.F.A., Woolwich.

25/4/1921.

Lawrence, Major C. T., D.S.O., from IV. Res. Bde. R.F.A., Woolwich, to Command City of London R.H.A., T.F., Armoury House, E.C. (on appointment to R.H.A.).

Roney-Dougal, Capt. C. N., M.C., from R.A. Depôt India, to 110th Batty. R.F.A., Jubbulpore.

Sherbrooke, Lt.-Col. N. C. H., D.S.O., from Staff, Mesopotamia, to 13th Bde., R.F.A., Woolwich.

27/4/1921.

Graver, Lieut. A., from att. Provost Branch, Rhine, to 3rd Bde. R.F.A., Rhine.

28/4/1921.

Fagan, Lieut. R. W. F., M.C., from att. Infantry, Ireland, to 30th Bde. R.F.A., Kildare.

Loader, Lieut. W. R., M.C., from att. Provost Branch, Rhine, to 3rd Bde. R.F.A., Rhine.

Spurrier, 2nd Lieut. R. H., from 30th Bde. R.F.A., Kildare, to att. Infantry, Ireland.

29/4/1921.

Mitchell, Lieut. A. J., from att. K.O.R. Regt., Ireland, to 53rd Batty. R.F.A., Fermoy.

Powell, Major R. ff., D.S.O., from V. Res. Bde. R.F.A., Woolwich, to 508th Batty., R.F.A., Woolwich.

2/5/1921.

Wyatt, Lt.-Col. G. N., D.S.O., from Medical Board Leave, to To Command, 2nd Res. Bde. R.F.A., Preston, with effect from 1/6/21.

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Postings R.H. & R.F.A.—*Continued.*

5/5/1921.

Athill, Major L. F. I., from Att. M.I. 2 War Office, to Att. IV. Res. Bde., R.F.A., Woolwich.

9/5/1921.

Aldridge, Lieut. A. W., from Att. Infantry, Ireland, to 1st Bde. R.F.A., Kilkenny.

11/5/1921.

Bittleston, Major K. G., D.S.O., from M.B. Leave, to 59th (Home Counties) Bde. R.F.A., T.F., Dover.
McCall, Capt. A. G., from 19th Bde. R.F.A., Mespot, to III. Res. Bde. R.F.A., Hilsea.
McNaughton, Capt. F. L., D.S.O., from Adjt. 1st and 2nd City of London R.H.A., T.F., to Adjt. H.A.C. Infantry.
Spendlove, Lieut. W. H., from V. Res. Bde. R.F.A., Woolwich, to 146th Batty., R.F.A., Kilkenny.

Alterations in Postings.

Needham, Lieut. J. H., Ref. War Office letter 25/11/1920. Now posted 17th Bde., R.F.A.
Robinson, Capt. W. H., Ref. War Office letter 23/3/1921. Now posted 32nd Bde. instead of 18th Bde., R.F.A.

Staff Appointments.

23/4/1921.

Morton, Capt. A. H., M.C., from Capt. I.G., Larkhill, to I.G. at Wahn Camp, Germany, from 15/5/21 to 30/6/1921.

1/4/1921.

Blaker, Lt.-Col. W. F., D.S.O., O.B.E., from G.S.O. 1, War Office, to G.S.O. 2, War Office.

20/4/1921.

Gibb, Lieut. J. D., M.C., from unposted to Retired with Gratuity, with rank of Capt.
Law, Lieut. G. H., from Special Employ, to Retired with Gratuity, with rank of Capt.
Williams, Lieut. W. E. G., M.C., from Records, to Retired with Gratuity, with rank of Capt.

22/4/1921.

Cooke, Major E. D. M. H., D.S.O., from unposted to Retired, with rank of Lt.-Col.

24/4/1921.

Mills, Lieut. G. A., from 27th Bde. R.F.A., to retired with Gratuity.

26/4/1921.

Aiton, Major R. S., M.C., from Staff, India, to Half-pay.

27/4/1921.

Burgess, Lieut. G. H., from Cipher Offr. Rhine, to Cipher Offr. Graded Class H.H., G.H.Q., Cairo.
Rymer-Jones, Lieut. J. M., M.C., from Cipher Offr. Rhine, to Cipher Offr., Graded Class H.H., G.H.Q., Cairo.
Uniacke, Major C. D. W., O.B.E., from 9th Bde. R.F.A., to Retired pay.

Taggart, Lieut. (D.O.) P., to Asst. to C.I. Inspection Dept., 11/3/1921.
Brownlow, Major C. A. L., D.S.O., from 22nd Bde. R.F.A., Lahore, to Staff Officer R.A., Northern Comd., India, 17/4/21.
Buchan, Capt. D. A., D.S.O., from 22nd Bde. R.F.A., Lahore, to Adjt. 22nd Bde., R.F.A., 17/4/1921.
O'Farrell, Lieut. R., M.C., from 23rd Bde. R.F.A., Mhow, to I.O.D., Rawal Pindi, 19/4/1921.

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Postings R.H. & R.F.A.—*Continued.*

Jenner, Lieut. S. B., from Att. Irish Command, to Document Officer, 5th Divn., 22/4/1921

Thorneycroft, Major G. E. M., D.S.O., from unposted, to I.A.C. Dusseldorf, 27.4.1921.

Turner, Capt. W. A. S., M.C., from IV. Res. Bde. R.F.A., Woolwich, to P.A., to D.P.S., War Office, 27/4/1921.

Cotter, Capt. R. K., M.C., from 35th Bde. R.F.A., Bulford, to Indian Ordnance Dept., 6/5/1921.

Kinsman, Lt.-Col. G. R. V., C.M.G., D.S.O., from Half-pay List, Appointed to Chilean Army, 9/5/1921.

Herbage, Lieut. K. A. from Irish Command, to W.A.F.F., 11/5/1921.

Miscellaneous.

6/7/1920.

Campbell, Lieut. A. P., from 24th Bde. R.F.A., to S. Capt. Jubb. Bde. Area.

2/8/1920.

Ryan, Capt. C. E., M.C., from 25th Bde. R.F.A., to S.O. R.A., E. Cmd., India.

21/8/1920.

Cust, Lieut. L. G. A., from unposted to Palestine Admin., Class H.H.

1/11/1920.

Hall, Capt. H. R., D.S.O., M.C., from 32nd Bde. R.F.A., to Staff Offr. R.A., West Comd., India.

19/3/1921.

Ball, Lieut. (D.O.) W. J., on 1st Appt. to D.O. from Lieut. Half-pay List, to Exptl. Estab., Shoeburyness.

1/4/1921.

Vining, Lieut. F. E., Irish Command, Awarded M.B.E.

Postings.—Royal Garrison Artillery.

16/4/1921.

Richardson, Capt. G. P., from 19th Batty. R.G.A., Tallaght, to Gibraltar.

18/4/1921.

Dupuis, Lieut. R. D., from 5th Pack Arty. B.A.C., Palestine, to 29th Pack Batty. R.G.A., Palestine.

Meyrick-Jones, Lieut. A. S. M., from 29th Pack Batty. R.G.A., Palestine, to 5th Pack Arty. B.A.C., Palestine.

19/4/1921.

Kerrison, Lieut. A. V., from Staff Capt., Brit. Mil. Mission, S. Russia, to "P" Coast Batty. R.G.A., Pembroke Dock.

20/4/1921.

Stokes, Lieut. E. L., from att. P. of W. Vol., Ireland, to 5th Bde. R.G.A., Tallaght.

22/4/1921.

Evans, Capt. E. A. from 1 Depôt R.G.A., Catterick, to II Res. Bde., R.G.A., Catterick.

Poole, Capt. H., from H.Q., D.E. R.G.A., Portsmouth & Portland, Portsmouth, to II. Res. Bde., R.G.A., Catterick.

27/4/1921.

Crane, Capt. R., from "P" Coast Batty. R.G.A., Pembroke Dock, to Sierra Leone.

Crawford, Major & Bt. Lt.-Col. R. D., D.S.O., from 33rd Batty. R.G.A., Bordon, to 14th Batty. R.G.A., Shoeburyness.

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R.G.A. Postings.—*Continued.*

29/4/1921.

Marshall, Major H. S., D.S.O., from 8th Bde. R.G.A., Exeter, to H.Q. Eastern Command.
Underhill, Capt. N., from 10th Bde. R.G.A., Larkhill, to H.Q. Eastern Command.

30/4/1921.

Goldney, Major H. W., O.B.E., M.C., from att. 9th Bde. R.G.A., Bordon, to att. 10th Bde. R.G.A., Larkhill.
Temple, Lieut. (D.O.) F. W., from 4 Depôt R.G.A., Great Yarmouth, to Sierra Leone.
Wark, Lieut. (D.O.) H., M.B.E., from Exptl. Estab., Shoeburyness, to India.

2/5/1921.

Leah, Major T. C., D.S.O., from 37th Batty. R.G.A., Larkhill, to 5th Batty. Pack Arty., R.G.A., Longmoor.

3/5/1921.

Barton, Major R. L., D.S.O., from Att. 7th Coy. R.G.A., Gibraltar, to To Command, H.Q. & D.E., R.G.A., Gibraltar.
Cobbe, Major I. S., D.S.O., from 5th Batty. Pack Arty. R.G.A., Longmoor, to Command, 2nd Pack Arty. Bde., R.G.A., Longmoor.
Campbell, Major K. G., D.S.O., from 15th Batty. R.G.A., Shoeburyness, to Command, 8th Bde., R.G.A., Exeter.
Crozier, Major (Bt. Lt.-Col.) C. D., from Att. G.H.Q., Ireland, to Command, South Irish Coast Defences, Queenstown.
Forbes, Major J. L., D.S.O., M.C., from Peterhead Batty., 1st (Highland) Med. Brigade R.G.A., T.F., to Command, 1st (Highland) Med. Bde., R.G.A. T.F.
Hearn, Major H. S., from 2nd Res. Bde., R.G.A., Catterick, to Command, H.Q. & D.E., R.G.A., Tees & Tyne, Tynemouth.
Hill, Major R. R., D.S.O., from 13th Batty. R.G.A., Shoeburyness, to Command, 10th Bde. R.G.A., Larkhill.
Macfarlan, Major J. B., D.S.O., from Commanding, 1st (Highland) Med. Bde., R.G.A., T.F., to Command, 1st Pack Arty. Bde., R.G.A., Bulford.
Mitchell, Major A., D.S.O., from North Irish Coast Defences, Carrickfergus, to Command, North Irish Coast Defences, Carrickfergus.
Niven, Major (Bt. Lt.-Col.) O. C., D.S.O., from "G" Coast Batty. R.G.A., Portsmouth, to Command, 7th Bde. R.G.A., Fermoy.
Price, Major O. L., D.S.O., from 19th Batty., R.G.A., Tallaght, to Command, 5th Bde. R.G.A., Tallaght.

6/5/1921.

Coe, Major J., from Adjt. Durham and Tynemouth R.G.A., T.F., to G.H.Q., Ireland.
Dunne, Major T. F. K., from Att. Infantry, Ireland, to "P" Coast Batty. R.G.A., Pembroke Dock.
Strachan, Major D. A., from Att. Headquarters, Guernsey, to Adjt., Royal Guernsey Arty. and Engineers (Militia) Guernsey.
Treatt, Capt. B. D. C., M.C., from "A" Coast Batty. R.G.A., Edinburgh, to Adjt., Durham & Tynemouth R.G.A., T.F., West Hartlepool.

10/5/1921.

Pemberton, Capt. A. L., M.C., from 9th Batty. Pack Arty., Longmoor, to Att. No. 1 Pack Arty. Bde., Bordon.

11/5/1921.

Brown, Capt. L. N. F., D.S.O., from R.G.A., Gibraltar, to Soudan Detachment, Khartoum.
Peck, Major (Bt. Lt.-Col.) S. C., D.S.O., from Leave Unposted List, to 33rd Batty. R.G.A., Bordon.
Ryan, Capt. C. J., from No. II. Res. Bde. R.G.A., Catterick, to R.G.A., Gibraltar.
Shadbolt, Capt. C., from Artillery College, Woolwich, to H.Q. & D.E., R.G.A., Thames & Medway, Sheerness. (As I.G.).

12/5/1921.

Jackson, Lieut. L. H., from II. Res. Bde. R.G.A., Catterick, to "I" Coast Batty., R.G.A., Plymouth.
Newnham, Capt. E. P., from Att. 2nd Tank Battalion, Wool, to 19th Batty., R.G.A., Tallaght.

Cancellation of Posting.

Leah, Major T. C., D.S.O., posting to Indian Pack Arty., India, dated 5/3/21.

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R.G.A. Postings.—*Continued.*

Alterations in Postings.

Hunter, Major (Bt. Lt.-Col.) (D.O.) J., O.B.E., Assumed Duty as Adjutant 3rd Indian D.A.C., Meerut.

Staff Appointments.

25/4/1921.

Warton, Capt. (D.O.) H. C., from Ordnance College, to Quarter-Master in D. of A. (A5) War Office.

3/12/1920.

Drake-Brockman, Major V., to Instr. Arty. College.

23/3/1921.

Kennedy, Lieut. Q. A., to R.A.F.

26/3/1921.

Walker, Capt. M. G. E., D.S.O., to Asst. Mil. Secretary, Gibraltar.

1/4/1921.

Kingscote, Capt. Bt. Major A. R. F., M.C., to Staff Captain, Eastern Command.
Phillips, Major Bt. Lt.-Col. F. R., D.S.O., to B.M., R.A., Western Command.

4/4/1921.

Woodward, Lieut. W. L., to Tanks.

6/4/1921.

Lister, Major (Bt. Lt.-Col.) F. H., D.S.O., to D.A.A. & Q.M.G., S.E. Area.

Churcher, Major G. M., M.C., from Staff, War Office, to Special Appointment, Constantinople, 23/3/1921.
White, Lieut. F. F., from "B" Coast Batty., Edinburgh, to King's African Rifles, 1/4/1921.
Roupell, Capt. F. L. L. F., M.C., from Staff Capt. R.A., Aldershot Command, to Adjutant, Territorial Force, 1/4/1921.
Barne, Major W. B. G., C.B.E., D.S.O., from 4th Bde. R.G.A., Shoeburyness, to G.S.O. 2, 26/4/1921.
Douglas-Jones, Capt. (Bt. Maj.) S. D., D.S.O., M.C., from War Office, to Bde. Maj. R.A., Hd. Qrs., Eastern Command, 27/4/1921.
Stevens, Major (Bt. Lt.-Col.) H. R. G., D.S.O., from G.S.O. 2, Army of Black Sea, to D.A.Q.M.G., 28th Divn., British Army in Constantinople, 10/5/1921.
Willis, Lieut. A. G. de L., from Headquarters, Ireland, to Ships' Adjutant Cork, and to be temporary Capt. without pay and Allowances, 7/5/1921.
Langhorne, Major (Bt. Lt.-Col.) A. P. Y., D.S.O., M.C., from Staff, Eastern Comd., to Instructor, Senior Officers' School, Woking, 13/5/1921.

Cancellation of Staff Appointments.

Byrne, Major (Bt. Lt.-Col.)J. D., D.S.O., Appointment as Bde. Major R.A., Hd. Qrs., Eastern Command is cancelled.

REGIMENTAL LIST. The following Casualties have taken place from 16th April, to 15th May, 1921.

Promotions.

Alexander, Major W. D., D.S.O., to be Lt.-Col., 1st May, 1921.
Barton, Major R. L., D.S.O., to be Lt.-Col., 1st May, 1921.
Bayley, Major (Bt. Lt.-Col.) L. S., D.S.O., to be Lt.-Col., 1st May, 1921.
Bird, Major M. H. C., to be Lt.-Col., 1st May, 1921.
Beasley, Major J. H. M., D.S.O., to be Lt.-Col., 1st May, 1921.
Clapham, Major D., D.S.O., O.B.E., to be Lt.-Col., 1st May, 1921.
Climo, Major P. H., to be Lt.-Col., 1st May, 1921.
Colville, Major A. M., D.S.O., to be Lt.-Col., 1st May, 1921.
Cresswell, Major (Bt. Lt.-Col.) E. F., D.S.O., to be Lt.-Col., 1st May, 1921.
Cobbe, Major I S., D.S.O., to be Lt.-Col., 1st May, 1921.

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Promotions—Continued.

Campbell, Major K. G., D.S.O., to be Lt.-Col., 1st May, 1921.
Crozier, Major (Bt. Lt.-Col.) C. D., to be Lt.-Col., 1st May, 1921.
Gayer-Anderson, Major (Bt. Lt.-Col.) T. G., C.M.G., D.S.O., to be Lt.-Col., 6th April, 1921.
Greene, Major (Bt. Lt.-Col.) A. C. R., to be Lt.-Col., 1st May, 1921.
Holme, 2nd Lt. P. C., to be Lieut., 23rd Jan., 1921.
Hearn, Major H. S., to be Lt.-Col., 1st May, 1921.
Hutchison, Major K. D., to be Lt.-Col., 1st May, 1921.
Haig, Major (Bt. Lt.-Col.) A. G., C.M.G., D.S.O., to be Lt.-Col., 1st May, 1921.
Hill, Major R. R., D.S.O., to be Lt.-Col., 1st May, 1921.
Jelf, Major (Bt. Lt.-Col.) W. W., C.M.G., D.S.O., to be Lt.-Col., 1st April, 1921.
Jones, Major (Bt. Lt.-Col.) J. H. H., D.S.O., to be Lt.-Col., 1st May, 1921.
Marryat, Major R., D.S.O., to be Lt.-Col., 1st April, 1921.
Macfarlan, Major J. B., D.S.O., to be Lt.-Col., 1st May, 1921.
McGhee, Major A. S. P., D.S.O., to be Lt.-Col., 1st May, 1921.
Mitchell, Major A., D.S.O., to be Lt.-Col., 1st May, 1921.
Niven, Major (Bt. Lt.-Col.) O. C., D.S.O., to be Lt.-Col., 1st May, 1921.
Preeston, Major (Bt. Lt.-Col.) N. P. R., D.S.O., to be Lt.-Col., 6th April, 1921.
Price, Major O. L., D.S.O., to be Lt.-Col., 1st May, 1921.
Richey, Major F. W., D.S.O., to be Lt.-Col., 1st May, 1921.
Robinson, Major J. A. P., D.S.O., to be Lt.-Col., 1st May, 1921.
Vandeleur, Major (Bt. Lt.-Col.) H. M., C.B.E., to be Lt.-Col., 1st May, 1921.
Wighton, Major (Bt. Lt.-Col.) E., D.S.O., to be Lt.-Col., 1st May, 1921.

To Half Pay.

Aiton, Lieut. R. S., M.C., 25th April, 1921.
Anley, Major W. B., D.S.O., 1st May, 1921.
Birtles, Lieut. H., 17th Oct., 1920.
Bowen, Lt.-Col. H. W., C.I.E., D.S.O., 1st May, 1921.
Boyd, Lt.-Col. S. O., 1st May, 1921.
Bullen, Lt.-Col. S. D., D.S.O., 1st May, 1921.
Corbett, Lt.-Col. E. F., D.S.O., 1st May, 1921.
Corrie, Lt.-Col. G. G. W., 1st May, 1921.
Cotter, Lt.-Col. H. J., C.I.E., D.S.O., 1st May, 1921.
Currie, Lt.-Col. I. B. F., D.S.O., 1st May, 1921.
Eady, Lt.-Col. C. E., 1st May, 1921.
Easton, Lt.-Col. F. A., D.S.O., 1st May, 1921.
Fergusson, Lt.-Col. A. C., C.M.G., D.S.O., 1st May, 1921.
Fowler, Lt.-Col. W. J., 1st May, 1921.
Freeth, Lt.-Col. C. J. D., 1st May, 1921.
Hanna, Lt.-Col. J. C., D.S.O., 1st May, 1921.
Haynes, Lt.-Col. K. E., C.M.G., C.B.E., 1st May, 1921.
Hicks, Lieut. W. E., D.S.O., M.C., 17th May, 1921.
Kelly, Lt.-Col. C. R., C.M.G., D.S.O., 1st May, 1921.
Lawrence-Archer, Lt.-Col. J. H., C.I.E., 1st May, 1921.
Lockhart, Lt.-Col. R. N., D.S.O., 1st May, 1921.
Lyddon, Lt.-Col. W. G., C.M.G., 1st May, 1921.
McLeod, Lieut. W. G. M., 23rd April, 1921.
Mackenzie, Lt.-Col. G. B., C.B., C.M.G., D.S.O., 1st May, 1921.
Mayne, Lt.-Col. H. B., D.S.O., 1st May, 1921.
Molesworth, Lt.-Col. H. E., C.M.G., D.S.O., 1st May, 1921.
Muspratt-Williams, Lt.-Col. R. L., 1st May, 1921.
Nuttall, Lt.-Col. C. M., D.S.O., 1st May, 1921.
Owen, Lt.-Col. C. H. W., C.M.G., D.S.O., 1st May, 1921.
Palmer, Lt.-Col. C. C., 1st May, 1921.
Paterson, Lt.-Col. P. J., C.M.G., 8th May, 1921.
Phipps, Lt.-Col. C. F., D.S.O., 1st May, 1921.
Reade, Lt.-Col. P. N. G., 1st May, 1921.
Riddell, Lt.-Col. R. B., D.S.O., 1st May, 1921.
Rowan-Robinson, Lt.-Col. H., C.M.G., 1st May, 1921.
Rumbold, Lt.-Col. W. E., C.M.G., 1st May, 1921.
Sturrock, Lt.-Col. G. C., 1st May, 1921.
Swinton, Lt.-Col. C. W., C.M.G., D.S.O., 1st May, 1921.
Twiss, Lt.-Col. F. A., C.M.G., D.S.O., M.V.O., 1st May, 1921.
Walker, Lt.-Col. E. W. M., 1st May, 1921.
Waring, Lt.-Col. R., 1st May, 1921.
Wilkinson, Lt.-Col. A. C., C.M.G., D.S.O., 1st May, 1921.
Wilkinson, Lt.-Col. M. L., 1st May, 1921.

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Retirements on Retired Pay.

Bowers, Lieut. H., from half-pay, 20th April, 1921.
Brett, Lt.-Col. H. G., from half-pay, 16th April, 1921.
Brockman, Lieut. J., M.C., from half-pay, 17th April, 1921.
Burgess, Lieut. R. A., M.B.E., from half-pay, 3rd May, 1921.
Carpenter, Lieut. F., M.C., from half-pay, 3rd May, 1921, with rank of Major.
Catt, Lieut. E. W., M.C., from half-pay, 21st April, 1921, with rank of Capt.
Clark, Lieut. G. A., from half-pay, 20th April, 1921, with rank of Capt.
Cooke, Lieut. A. O., from half-pay, 16th April, 1921, with rank of Capt.
Cooke, Major E. D. M. H., D.S.O., 22nd April, 1921, with rank of Lt.-Col.
Collison, Lieut. A. E., from half-pay, 10th May, 1921, with rank of Capt.
Collison, Lieut. H. L., M.C., 6th May, 1921, with rank of Capt.
Desmond, Lieut. A. E., from half-pay, 30th April, 1921,
Disley, Lieut. H., from half-pay, 19th April, 1921.
Fetherston, Lieut. H. B., M.C., M.B.E., from half-pay, 19th April, 1921, with rank of Major.
Fitzgerald, Lt.Col. M. J. F., D.S.O., from half-pay, 26th April, 1921.
Foster, Capt. E. A., 13th May, 1921.
Gallagher, Lieut. H., from half-pay, 30th April, 1921.
Gittings, Lieut. T. A., O.B.E., from half-pay, 16th Apr. 1921, with rank of Major.
Gulliver, Lieut. J., from half-pay, 1st May, 1921.
Hare, Major E. F., from half-pay, 3rd May, 1921.
Hardy, Lieut. C. W., from half-pay, 1st May, 1921.
Hardy, Lieut. W. A., from half-pay, 18th May, 1921, with rank of Capt.
Hill, Lieut. L. V., 8th May, 1921.
Holmes, Lieut. F. S., from half-pay, 16th April, 1921, with rank of Capt.
Ison, Lieut. B. S., from half-pay, 30th April, 1921, with rank of Capt.
Kennedy, Lt.-Col. A. C., D.S.O., 1st May, 1921.
Lawlor, Lieut. C., from half-pay, 30th April, 1921.
Mackey, Lieut. M. J., from half-pay, 16th April, 1921.
Marton, Lt.-Col. R. O., C.M.G., D.S.O., 1st May, 1921.
Moloney, Lieut. A. M., from half-pay, 30th April, 1921, with rank of Capt.
Moore, Lieut. F. C., M.C., from half-pay, 5th March, 1921, with rank of Major.
Moore, Lt.-Col. St. L. M., from half-pay, 6th May, 1921.
Parker, Lieut. G. H., M.C., from half-pay, 10th May, 1921, with rank of Major.
Spedding, Lt.-Col. E. W., C.M.G., from half-pay, 16th April, 1921, with hon. rank of Brig.-Genl.
Smith, Lieut. P. S., M.C., from half-pay, 25th Oct., 1920.
Square, Lieut. G. M. E., 23rd April, 1921, on account of ill health.
Swallow, Lieut. H. E., from half-pay, 28th April, 1921.
Turner, Lieut. S., from half-pay, 23rd April, 1921, with rank of Capt.
Uniacke, Major C. D. W., O.B.E., 27th April, 1921.
Walthall, Col. E. C. W. D., C.M.G., D.S.O., 30th April, 1921, with hon. rank of Brig.-Genl.
Warner, Lieut. J., from half-pay, 4th May, 1921.
Wheeler, Lt.-Col. E. L., from half-pay, 17th May, 1921.
Whittles, Lieut. H., from half-pay, 7th May, 1921, with rank of Capt.
Winter, Lieut. F. J., from half-pay, 3rd May, 1921, with rank of Capt.
Woodhouse, Lieut. C. H., from half-pay, 29th April, 1921.
Woodroffe, Major C. R., C.M.G., C.B.E., 5th May, 1921, with hon. rank of Brig.-Genl.
Ziegler, Major C. L., D.S.O., 13th May, 1921.

Retirements with a Gratuity.

Burtonwood, Capt. T., 16th April, 1921.
Gibb, Lieut. J. D., M.C., 20th April, 1921, with rank of Captain.
Hodges, Lieut. A. H. F., from half-pay, 18th May, 1921.
Ireland, Capt. K. G., M.C., 14th May, 1921.
Law, Lieut. G. H., 20th April, 1921, with rank of Capt.
McLeod, Lieut. W. G. M., from half-pay, 3rd May, 1921.
Mills, Lieut. G. A., 24th April, 1921.
Roberts, Lieut. M., from half-pay, 26th April, 1921.
Williams, Lieut. W. E. G., M.C., 20th April, 1921, with rank of Capt.

Resignations.

Findlay, Lieut. V. A. C., 16th April, 1921.
Russell, Lieut. D. G., M.C., 16th April, 1921, with rank of Capt.
Stockley, Lieut. R. M., M.C., 16th April, 1921.

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Cashiered.

Know, Lieut. A. E., R.G.A., 17th March, 1921.

Deaths.

Arbuthnott, Lt.-Col. Rt. Hon. W. C. R., Viscount, 9th Aug., 1920.

GIFTS AND PURCHASES FOR THE MONTH OF MAY, 1921.

Books Presented.

By The Secretary, War Office.

Musketry Regulations, Part I. 1909. (Reprinted with Amendments, 1914.) Addendum No. 5, February, 1921. Bayonet Training.

By The Secretary, Institution of Mechanical Engineers.

Proceedings of the Institution of Mechanical Engineers, 1920. (July—December.)

By The Publishers.

Battle Studies: Ancient and Modern Battle. By Col. Ardant du Picq. French Army. Trans. New York (Macmillan) 1921.

Books Purchased.

Chronology of the War, Vol. III. 1918-19. London (Constable) 1920.

Scientific Method: Its Philosophy and its Practice. By F. W. Westaway. London (Blackie & Son) 1919.

A brief record of the Advance of the Egyptian Expeditionary Force under the Command of General Sir E. H. H. Allenby, G.C.B., G.C.M.G. July, 1917 to October, 1918. London (Stationery Office) 1919.

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The Journal of the Royal Artillery.
July, 1921.

"Duncan" Silver Medal Essay, 1920-21. "In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for Horse Draught, both on the road and across country." By Capt. D. R. D. Fisher, D.S.O., R.F.A. 109

Mechanical Traction versus Horses. Together with some suggestions for suitable types of Artillery in the future. (Being the substance of a Lecture delivered before the Gunnery Staff Course, at the School of Artillery, 15th March, 1921.) By Brevet Major R. Crofton, M.C., R.G.A. 130

Notes on the Co-operation of the Infantry and Artillery of a Division. By Colonel H. W. Newcome, C.M.G., D.S.O. ... 140

Our Artillery in Italy. By Major A. G. Rolleston, O.B.E., R.F.A. 146

Anti-Aircraft? (Reprinted from the "Journal of the United States Artillery," February, 1921.) By Major H. J. Knerr, C.A.C. 151

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"DUNCAN" SILVER MEDAL ESSAY, 1920-21.

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for Horse Draught, both on the road and across country."

BY CAPT. D. R. D. FISHER, D.S.O., R.F.A.

"THE FORM DECAYS, THE FUNCTION NEVER DIES."

PART I. M.T. AND THE ARMY.

I. *The Basis of Discussion.*

1. The primary function of the Artillery being to support the Infantry, the question of the substitution of mechanical transport for horse draught cannot profitably be discussed without first considering what kind of Infantry the Artillery of the future will be called upon to support, i.e. :—

i. Whether the mobility of the Infantry is likely to be increased by a wide use of mechanical transport on their part.
ii. If so, in what direction such development may be expected.

2. In this preliminary examination of the more general question, it is necessary to bear in mind :—

i. The types of campaign to be expected, and the nature of the various theatres of operations.
ii. The relation of the Regular Army to the Land Forces of the Empire.
iii. The inter-relation between military, industrial and political considerations.

3. The ground having been thus cleared, the question of mechanical transport can be discussed in the more specific aspect of its application to the Artillery of the Field Army.

II. *Possible lines of development.*

1. The primary military object of an extended application of mechanical transport to the army in general is to secure increased mobility, whether strategical or tactical or both, in order :—

i. To facilitate surprise.
ii. To prevent trench-warfare from supervening.
iii. To make an end of it, if it does supervene.
iv. To force a rapid decision.

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2. For the purposes of the question under discussion, it is sufficiently accurate to say :—

i. That strategic mobility means mobility on the road; to be secured by any form of mechanical transport.

ii. That tactical mobility means mobility across country; to be secured only by the adoption of some type of caterpillar tractor.

3. The forms of mechanical transport to be adopted by the artillery in substitution for horse draught may in consequence be epitomized as follows :—

i. Infantry, as at present: artillery, direct substitution, i.e. capable of 5 m.p.h. on the road, if possible of a higher speed for a short distance; and of moving across and manœuvring in any nature of country negotiable by a team of horses.

ii. Infantry moving by lorry but fighting as at present: artillery as above, but capable of a sustained pace of say 20 m.p.h. on a good road.

iii. Infantry moving and fighting in or from cross-country tractors or tanks: artillery must conform.

4. Such are the three main courses that appear to be open to the infantry, with their necessary reactions on the artillery; and though the last of them may seem too remotely visionary to be included in the purview of practical politics, so many outbursts of unqualified enthusiasm have recently been occasioned by this question of 'naval warfare on land' that an examination of it, however cursory, is unavoidable. With these three possible solutions in view the general problem can now be approached, firstly from its purely military aspect.

III. *The Rôle of the Regular (Home) Army in War.*

1. The types of campaign in which the Empire may expect to be engaged are four :—

i. A very small war, which will be confined to forces more or less on the spot, e.g. a Frontier War in India.

ii. A Small War, carried out by the Expeditionary Force, possibly supplemented by local contingents.

iii. A Great War, in which the Expeditionary Force is progressively reinforced, until all the resources of the Empire have been brought into play.

iv. A Medium War, requiring more military effort than ii, but less than iii.

To these must be added the repression of rebellion; but as this task cannot even in these days be considered a primary function of the Regular Army, such duties, though they may modify its distribution and impede its training, do not fundamentally affect its equipment and organization.

2. The rôle of the Regular (Home) Army in War is therefore twofold :—

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i. In a Small War it acts independently against an enemy who is exceedingly unlikely to be well equipped according to present-day standards. Such a war may break out in almost any part of the Empire, and the Regular (Home) Army must therefore be prepared for any nature of terrain, and cannot count on roads, railways, supplies or facilities for repair in or even near the theatre of operations.

ii. In a Medium or Great War the Regular (Home) Army is the forerunner of the armed forces of the Empire. At first it operates either independently or in conjunction with allies or with the local forces, and on its energy and success in this period it largely depends whether or not the campaign is brought to a satisfactory conclusion without developing into a Great War. Ultimately however the Regular Army loses its identity and becomes merged in the Imperial Forces. The main theatre of either a Medium or a Great War is probably, but not necessarily, European or quasi-European, i.e. more or less well provided with communications, repair facilities, etc.; and the enemy must prima facie be supposed to be well organized and equipped.

3. As regards mechanical transport, the deductions to be drawn from these two rôles of the Regular (Home) Army are :—

i. A Small War: tactical superiority should not be difficult of attainment; mechanical energy is therefore best devoted to questions of supply.

ii. A Medium or Great War: since so much depends on the issue of the opening campaign, no practicable step should be neglected which can in any way increase the military efficiency of the force, not even excepting the universal adoption of tanks.

4. With two such conflicting parts to play in War, the one—let us hope—the more probable, the other unquestionably the more vital, it seems evident that a compromise must be effected, with a substantial bias towards the more important task: but not until the less spectacular but none the less fundamental rôle which the Regular (Home) Army performs in Peace has been considered, can the question be envisaged in its true perspective.

IV. *The Rôle of the Regular (Home) Army in Peace.*

1. The Imperial Land Forces, broadly considered, fall into four categories :—

i. The Regular Army:
   (a) At home.
   (b) In India.
   (c) In other overseas garrisons.

ii. The Territorial Force.

iii. The Indian Army.

iv. The Dominion Forces.

2. The Regular Army at home is nowadays generally thought of as consisting of six divisions forming an Expeditionary Force.

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That organization is however strictly speaking secondary: primarily the Regular Army at home consists of seventy-odd battalions of infantry, each of which maintains, i.e. is the draft-finding unit for, one of the seventy-odd battalions abroad. The divisional formation of the battalions at home is in fact an extraneous growth; an Expeditionary Force of six divisions fulfils no specific military function, but is merely a device to make the best possible use of the available raw material—the seventy-odd battalions that are the necessary counterpart of the overseas garrisons. No fundamental change in the equipment and organization of the Expeditionary Force, i.e. the Regular (Home) Army, is therefore practicable, unless either:

i. It is applicable to the Regular Army overseas also; or
ii. The present system of recruiting and draft-finding for the Regular Army overseas is completely altered.

3. The question is further complicated by the fact that financial responsibility for the bulk of the Regular Army overseas rests with the Indian Government. Fundamental alterations in equipment must therefore not only be suited to Indian conditions in a military sense, but must be financially acceptable to the Indian Government, never very prodigal of military expenditure in the past and now handicapped by diarchy and popular unrest. It is therefore only natural that the Indian Government, once satisfied that the equipment of their armed forces is adequate for their immediate needs, should devote such additional funds as may be available rather to redressing undeniable domestic grievances—conditions of pay, barrack accommodation, etc. —than to providing for possible future Imperial requirements. Imperial thinking is not the most salient characteristic even of more mature democracies.

4. The Territorial Force of fourteen divisions has, as at present organised, two rôles to carry out:—

i. To reinforce the Expeditionary Force.
ii. To form the cadres for such further expansion as may be necessary.

In both cases, a preponderance of higher commanders, instructors etc. must either be regular soldiers, or at least have been trained with the Regular Army; any wide disparity of organization and equipment, and consequently of training, must therefore inevitably involve considerable difficulty in providing the instructional, etc. staff of the Territorial Force even in Peace, but more particularly in the expansion necessitated by a Great War. Nor must it be forgotten that any suspicion, however unfounded, that the Territorial Force is being fobbed off with the discarded and discredited equipment of the Regular Army will have an adverse effect on recruiting, never very satisfactory at the best of times and conspicuously bad to-day.

5. The organization of the Indian Army at present differs considerably from that of the Regular (British) Army, and one of the main features of the Report of the Esher Commission is the emphasis which is laid on the desirability of bringing the two into line, as far as the special conditions of India admit. The Report lays stress on the inevitable difficulties of command and administration of a mixed

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force, British and Indian, with a different divisional organization and different systems of supply, and makes certain specific suggestions to reduce this disparity, e.g. the assimilation of the Indian S. and T. to the R.A.S.C. Any fundamental alteration in the equipment and organization of the Regular (British) Army, such as the wide-spread adoption of mechanical transport, would inevitably magnify this divergence and its attendant difficulties of co-operation in the field.

6. The Dominions Forces have different systems of recruitment and maintenance but have this in common, that they are organized on a divisional basis on the pattern of the Regular (Home) Army: if that army makes advances in equipment, organization and tactics which the Dominions are not in a position to follow, not only will the difficulties of their co-operation with it in a Great War be intensified, but the removal of a generally recognised model and standard will be apt to lead to an increasing divergence of military ideals between the various Dominions.

V. *General Deductions regarding the Regular (Home) Army.*

1. From the foregoing examination of the rôle of the Regular (Home) Army in Peace and War, the following deductions may be drawn :—

i. That it is truly independent only in a Small War, in which great elaboration of equipment is axiomatically unnecessary.

ii. That while it may be relatively independent in the opening campaign of a Great War, this independence is only temporary, disappearing as reinforcing divisions arrive.

iii. That on its success in this opening campaign, probably conducted in a European or quasi-European theatre, the most vital issues may depend.

iv. That the conduct of extensive military operations becomes more difficult in proportion as its organization, equipment and tactics differ from those of the Imperial Forces in general.

v. That its primary function in Peace is to provide drafts and reliefs for the Regular Army overseas.

vi. That its organization and equipment are in consequence inextricably bound up with the requirements of the Regular Army in India, which is not under the direct control of the British Government.

vii. That it is a school of instruction, if it does not actually provide instructors, for the Territorial and Dominions Forces.

viii. That its divisional organization is the model on which all the Imperial Forces are based, and that its tactical methods and standards of training are the pattern to which all other forces work, subject to their special local conditions.

2. The ideal to be aimed at therefore is plainly so to organize, equip and train the Regular (Home) Army as to secure for it the maximum military efficiency in its most vital rôle, the opening phases of a Great War; without however introducing such fundamental

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differences of equipment and organization as will throw difficulties in the way either of its co-operating with other imperial forces in War, or of its serving as their pattern and their guide in time of Peace. These requirements appear to be satisfied by the following solution :—

i. The present divisional organization to be retained.
ii. Arrangements to be made for supplying lorry convoys to transport the infantry of one or more divisions as may be desirable and practicable, when conditions as to roads, etc. permit.
iii. The horse transport of such divisions to be replaced by mechanical transport, part lorry, part cross-country tractor.
iv. The force to be supplemented by as strong a body of tanks as can be provided, partly at the expense of cutting down the cavalry and horse artillery.

3. It is admittedly a far cry from the above proposal to the land-fleet of the tank worthies. Even from a strictly military point of view however, the plan outlined appears to offer distinct advantages over the wholesale abandonment of infantry for tanks, but it remains to submit it to the ultimate test of all military equipment—the possibilities, viewed in the light of the economic and industrial resources of the Empire, of its provision in Peace and maintenance in War.

VI. *The Factors of Efficiency.*

1. The universal definition of Efficiency is that it is the relation between Effort and Effect, and military efficiency is no exception to this rule; the difficulty lies in applying it, or rather in deciding the basis of its application. A soldier measures Effect in terms of killing power, either :—

i. Direct : e.g. a more powerful or more fool-proof weapon; or
ii. Indirect : e.g. a device for securing increased mobility or additional immunity from the enemy's action.

The general public normally accepts the soldier's estimate of Effect, though probably 'cum grano'; unless indeed a slump in the stunt market has to be relieved by a press campaign on such highly technical questions as 'Great Ships or—' and 'No Air Force if—.' When however it comes to the estimation of Effort a compromise between two widely different points of view must generally be sought.

2. To the soldier qua soldier, Effort is necessarily appreciated in terms of man-power; his primary interest being centred on the men who actually use the equipment, those who maintain it occupying only a secondary share of his attention, and those who produce it hardly any share at all. To the civilian qua taxpayer on the other hand, Effort connotes one thing and one thing only—money; and the common ground to civilian and soldier is limited to the not very helpful truth that if some new equipment enables four men to do the work of five, it can be paid for without loss of efficiency by cutting down establishments by twenty per cent—a policy of robbing Peter to pay Paul which is only speciously sound even if Peter and Paul are both soldiers : but are they? The question must be examined in the light both of Peace and of War.

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VII. *The Financial Test of Peace.*

1. In Peace, the cost of equipment (which must be understood not in its technical sense but as including all forms of military apparatus, even to horses) comes under four main headings :—

i. Cost of provision.
ii. Cost of storage.
iii. Cost of maintenance.
iv. Cost of replacement.

2. For the purposes of the question at issue, no elaborate analysis is necessary; it will suffice if attention is drawn to the more salient points under each head :—

i. The cost of provision is naturally very much reduced, if the difference between the peace scale, based on training requirements, and the war scale can be made good from outside sources; i.e. if this balance need not be held in mobilization storage but can be procured at very short notice from the trade, either with or without previous registration and possibly subsidization. The same factor, i.e. facilities of trade supply, governs similarly the provision of war reserves over and above mobilization requirements.

ii. Except in the case of ammunition, which not only requires constant inspection, turn-over, etc., but is relatively compact, the chief factor in the cost of storage is not the personnel in charge but the actual accommodation, and for any given equipment this naturally depends on the extent to which mobilization and war reserve requirements have to be dealt with; i.e. ultimately on the possibilities of trade supply, as in i.

iii. It is not easy to generalize about the cost of maintenance; it may be said however that in very few cases is much gained by keeping equipment in store rather than in moderate use, quite apart from the training which its handling and cleaning affords to the troops. Wear and tear in moderate use are about balanced by deterioration in store; this is essentially true of any nature of machinery.

iv. The cost of replacement depends naturally on the life of the equipment, and that in turn depends on whether its pattern is the outcome of long and gradual evolution, or whether it is still in the embryonic stage of development; in the former case it will die in harness, or in less poetic phrase, it will be retained until it is cheaper to replace it than repair it, but in the latter it is likely to be scrapped as obsolete long before it is unserviceable.

3. On three of these heads the lorry has a distinct pull over the tank, for the lorry is a trade store of established pattern, which the tank most emphatically is not. On the score of maintenance there is not so much to choose between them without going into technical problems of petrol consumption for which, as regards the tank, little reliable data is available; but in view of its far simpler mechanism,

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the advantage appears to lie with the lorry on this score also. The lorry solution is therefore comparatively sound from the financial stand-point of Peace; skeleton cadres and a slight extension of the existing subsidy for standard lorries should secure sufficient transport to carry the infantry etc. of at least two divisions, and the number of lorries available is not at all likely to diminish. Moreover, this result can be secured without the political difficulties attendant on the accumulation of large stocks of vehicles in these days of press aeroplanes and picture papers; it will nevertheless be wise to examine it from the point of view of our industrial resources in War.

VIII. *The Industrial Test of War.*

1. 'On peut toujours trouver de l'argent pour faire la guerre'. If Rousseau's phrase is no longer literally correct, it is at least true to say that money loses some of its paramount importance in a Great War—and no military arrangements which ignore the possibility of a Great War can have any justification until the League of Nations has successfully inaugurated a millenium and an international police. What matters in a Great War is not so much whether one has money in one's pocket, as whether the shop is open; and the vital shops are the iron-monger's, the butcher's, the baker's and the candlestick-maker's—steel, meat, grain and oil. Meat does not affect the question under discussion, but steel, grain and oil in their relation to horse, lorry and tractor transport require careful if brief consideration.

2. Of iron and steel, Germany and ourselves respectively produced in 1917 and 1918 an output equal in round figures to 30 per cent and 25 per cent of that of the United States, France being a bad fourth with about 10 per cent. Later statistics are difficult to obtain, but the recovery of Alsace-Lorraine has materially improved France's position in relation to Germany, and the latter's output may be still further reduced as a result of the impending plebiscite in Upper Silesia. It must be added that some 30 per cent of our iron ore is imported, about half (3½ million tons in 1919) coming from Spain.

On the face of it, the situation looks not unfavourable: but when it is remembered that in the late war, with the United States at our back, the shortage of steel was so acute that the quantity available had to be meticulously rationed out between the Navy, the Army and the Air Force, it will be realized that the practicability of an ambitious scheme of mechanical transport does not depend solely on the good-will of the tax-payer—the good-will of the iron-monger is equally essential.

3. Of grain, it is as well to point out that the present world shortage is not solely due to war conditions. From 1870 to 1900, the increase in the area under cultivation—mainly in North America and South Russia—and in the yield per acre more than compensated for the increased population[1] of grain-consuming countries; from 1900 to 1914 the reverse tendency was displayed, and, failing the exploitation of such countries as Mesopotamia or the discovery of improved agricultural methods, the gradual elimination by grain-eating man of

[1] The population of Russia increased in one generation (1880—1910) from 100 to 150 millions.

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his rival the grain-eating horse is an economic necessity: unless indeed rice-eating man solves the problem in more drastic fashion—but the Yellow Peril is not yet to the fore. For the present, however, the Empire is approximately self-supporting in grain, the requirements of the United Kingdom being roughly balanced by the exportable surplus of Canada, Australia and India.

4. The oil question is so confused by political issues that it is not easy to arrive at a just appreciation of it. On the one hand is the statistical fact that in 1919 the United States produced 67 per cent, Mexico 15 per cent and the British Empire only 3 per cent of the world's output: on the other the assertion of Mr. Secretary Colby in his despatch to Lord Curzon in November 1920 on the subject of the Mesopotamian mandate, that the United States 'controls only one twelfth of the world's oil resources.' That oil is of paramount importance in War cannot be gainsaid, were it only that the Air Force is absolutely dependent on liquid fuel and the Navy rapidly becoming so; as full an examination as available information permits into the oil resources of the Empire and their prospects of development, and into the question of alternative liquid fuels, is therefore manifestly within the scope of this essay, but may with advantage be relegated to an Appendix.

5. From the point of view of a Great War therefore—and it cannot be too strongly emphasized that that prospect, however remote, must never be forgotten—military equipment must be developed with due regard to probable sources of supply which, as it has been endeavoured to show, are by no means unlimited: and there is another altogether modern factor, part industrial, part political, which the Army cannot affort to forget—the distribution and control of essential man-power. Time was when kings ruled kingdoms and commanded armies without let or hindrance—what cared Harry at Agincourt for those 'gentlemen in England now abed'? Came the Protectorate to govern the Kingdom and control its army— but the Self-Denying Ordinance preserved commanders from Parliamentary interference in the field. Then as war developed and became as much a matter of money as of men, political pressure increased—Wellington's Peninsular despatches disclose a ceaseless struggle against cabinet intrigues. Now constitutional interference is the least evil that the soldier has to fear—Cabinets may influence campaigns but Trades Unions decide the fate of battles. Every elaboration of equipment, every tendency to make the machine replace the man, is a surrender of military strength into the hands of non-military people. The possibly cryptic allusion to Peter and Paul, made some time since, may now be elucidated. If four men with a certain equipment equal five men without it, in the field, it is a fallacy to say that the two forces are equally efficient, even supposing it takes only one man to make and maintain the equipment in question. Multiply both sides by a million: one is 5,000,000 soldiers under military law; the vital portion of the other is 1,000,000 civilians under just so much law as their Trades Unions care to recognise. For food, for clothing, for arms and ammunition an army in the field is necessarily dependent on the good

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graces of the civil population: it can voluntarily commit itself to exclusive reliance on the seven-leagued boots of mechanical transport only at the price of additional risk of bruising the heel of Achilles.

IX. *General Conclusions of Part I.*

1. The general question of the extended use of mechanical transport by the Army has now been discussed from a variety of points of view, in the hope of arriving at a conclusion which should traverse no known requirements, military, financial, industrial or political. It is not proposed to recapitulate the argument step by step, since it has been endeavoured to rivet each successive link in its place, and if any of them are faulty a cursory examination of the whole chain is not likely to mend matters. The gist of the matter is that the least which the exigencies of a Great War demand, namely that one or two of the six divisions of the Expeditionary Force should be super-mobile on the road, is at present the most that is permitted by the governing conditions, whether military-domestic, financial, industrial or political. On the one hand some degree of increased mobility is manifestly necessary; of the other no aspect has been examined but counsels patience and moderation.

2. It may be thought that in what is necessarily a short essay, too much space has been devoted to extraneous considerations: 'Look before you leap' is a worthy motto, but is there not an equally pertinent—if singularly inappropriate—apothegm about 'Cutting the cackle'? The writer however is conscious not so much of the inordinate length as of the inadequacy of his preliminary examination, remembering the fate of the house built upon the sand—and what is petroleum, on which the whole question rests, but 'oil from the rock'?

PART II. M.T. AND THE ARTILLERY.

I. *Divisional Artillery of the Super-mobile Divisions.*

1. What is required for the artillery of a division of infantry moving in lorry convoys on the line of march but fighting on its feet as at present, is some form of mechanical transport capable of a sustained speed of 15 to 20 miles per hour on a good road, and able to move across country and to manœuvre at least as handily as a team of horses; moreover, in view of the danger of raids by fast-moving tanks, ability to fire on the move is desirable if not essential.

2. The first point is; wheel or track? No wheeled mechanical vehicle hitherto evolved can move over anything but the easiest country, nor, except at the expense of enormous wheels, does this system appear to offer any practical possibilities. In order to save any further reference to lorries in this connection, it may however be as well to mention here that:—

i. Lorries can carry field guns satisfactorily, and the emergency provision of ramps and clamping devices is comparatively simple.

ii. Lorries cannot tow field guns on their existing carriages at more than 5 m.p.h., even on good roads, without shaking their gears out of adjustment, if not causing more serious damage.

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But as a standard means of transport lorries are plainly out of the question in any normal terrain, and a satisfactory solution must therefore be sought in some type of track vehicle, rather than in one on wheels.

3. The next question is: what is this vehicle to be called upon to do? It may:—

i. Replace the team; i.e. tow the gun on its existing carriage.
ii. Carry the gun on its existing carriage.
iii. Carry the gun on some type of pedestal mounting.

The first idea may be at once dismissed as fruitless, since the necessary road speed cannot be attained without damage to the equipment; and any device to circumvent this drawback, such as mounting the gun-carriage on auxiliary wheels for travelling, is necessarily cumbrous and slow. The other two possible courses require examination in more detail.

4. Carrying the gun on its existing carriage has much in its favour without being altogether ideal:—

i. It utilizes the existing equipment, which is not only economical but makes for elasticity in the period of transition from horse to M.T. draught.
ii. It enables the machine to be withdrawn from the battery position. (Machine is ugly, and suggests a Scots wagonette; tractor misleading, as it suggests towage; let it be vector.)
iii. With an adequate ramp, time taken in coming into action should not be excessive.
iv. If the gun can be fired from the vector, great tactical elasticity would be obtained; moreover, if the ranging section opened fire from their vectors while the remainder were being ramped down, time taken in coming into action would be reduced to a minimum.
v. Guns could at a pinch be manhandled in the ordinary way into specially inaccessible positions.
vi. But the overall height when mounted is bound to be considerable.

5. The pros and cons of carrying the gun on some type of pedestal mounting are almost the exact reverse of the foregoing, the salient advantages of the latter course being the better firing conditions when mounted, notably the all-round traverse which a pedestal mounting would presumably give, and the reduced height on the move. Against these must be set certain disadvantages of a fundamental nature:—

i. If the pedestal mounting is fixed, the gun must be hard to conceal and particularly vulnerable in action.
ii. If the pedestal mounting is removable, this operation would almost certainly be both slow and clumsy.
iii. In either case manhandling into a difficult position would be out of the question.

As long as the tactical rôle of the infantry remains unaltered by wide use of cross-country mechanical transport on their part, the artillery supporting them must be prepared to occupy the same

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position for hours if not for days. Under these conditions therefore, the balance of advantage lies with the method of carrying the gun on its existing carriage, modified where necessary to admit of its effective use on emergency when on the move, or at least mounted at rest, and to reduce its overall height when mounted.

6. As regards reducing the overall height, there are two possible solutions :—

i. Countersinking the wheels in the carrying-platform of the vector : besides probably introducing mechanical complications, this device would necessarily impede the service of the gun when mounted.

ii. Reducing the size of the wheels : to this there is no serious objection, provided that the reduction in size is not so great as seriously to interfere with manhandling the carriage.

The latter alternative appears the better, though it could not result in any great reduction in overall height. As regards improved firing facilities when mounted, the crux of the matter is undoubtedly the traverse; this disability could be overcome :—

i. By fitting the vector with a traversing platform, thus adding considerably to its weight and to the overall height of the combination, i.e. vector and gun complete.

ii. By using the 18-pr. split-trail equipment and adopting a similar carriage for the 4·5-inch howitzer.

The latter course is manifestly the most promising, possibly with a still further modification. There is necessarily a minimum length for the vector, both to enable it to cross ditches and to ensure an adequate bearing surface for the tracks : any addition to this minimum length, which is presumably about twenty feet, is obviously a handicap in manœuvre, parking, etc., and it is not improbable that this length would be insufficient to accommodate the present split-trail equipment, together with engine, driver's seat, ammunition and so forth. To meet this difficulty recourse might be had to the jointed split-trail arrangement of the 3·7-inch howitzer, the gun firing from the shortened trail when mounted, and the extension pieces, carried on the vector, being fitted for dismounted action.

7. As mounted action would be the exception rather than the rule, there seems to be no necessity for any form of shield on the vector, except possibly for the driver's seat : the minimum military load would therefore be about 3 tons, made up as follows :—

Gun, carriage and extension pieces of trail,	say	30 cwt.
Ammunition (100 rounds 18-pr., 60 4·5″ how.)	say	20 cwt.
Driver, No. 1 and 2 gunners, with kit	say	7 cwt.
Ramp, spare parts, etc.	say	3 cwt.

If, as seems probable, the economical load were in excess of this, that is to say, if a twenty-foot track-driven vehicle would give better results as regards petrol consumption etc. if designed to carry a load less disproportionate to its own weight, there are three possible courses open :—

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i. To increase the amount of ammunition carried; in this way an additional 1½ tons could be absorbed (150 rounds 18-pr., 100 4·5-inch howitzer): to concentrate more than 250 rounds on the same vehicle as the gun seems unwise. An extra man might also be carried.
ii. Not to increase the direct load, but to tow an exactly similar but unengined vehicle carrying a second gun: two guns thus depending on one engine.
iii. Towing a similar but smaller vehicle carrying ammunition and the rest of the detachment.

As the course to be adopted depends entirely on a mechanical question of which the writer has no knowledge, it is idle to compare their respective merits; but i. has obvious military advantages, and ii. and iii. both suffer from the steering difficulties inherent in a tow, particularly when the trailer has no means of steerage of its own, as must be the case with an unengined track-vehicle. Nor can details of construction profitably be discussed except by the expert; presumably something of the nature of the rope-suspension of the Medium D tank offers the best hope of success—unless the conspiracy of silence that has followed Mr. Churchill's eulogistic references to that auspicious vehicle betokens yet another failure of the promise of spring.

8. Uncertainty as to how many rounds will actually accompany the gun renders discussion of the general question of ammunition supply both difficult and necessarily inconclusive: two broad principles may however be laid down, which scarcely seem open to argument:—

i. Conditions of trade supply dictate that lorries should as far as possible be used in favour of cross-country vehicles.
ii. Such of the latter as are required should be of a standard type in order to facilitate both repairs and manufacture: ammunition-vectors should therefore be the same as gun-vectors, less the special fittings of the latter as gun-platforms but including the ramp, so that they may on emergency be used as gun-carriers.

Subject to the problem of economic load, the most satisfactory military solution appears to be:—

i. With the battery.
   (a) 6 gun-vectors with 2 drivers, No. 1, 2 gunners and 250 rounds 18-pr. or 150 4·5-inch howitzer; i.e. a total load of about 5 tons.
   (b) 6 ammunition-vectors, same detachment with coverer in place of No. 1, extra spares including air recuperator, and 400 rounds 18-pr. or 250 4·5-inch howitzer; total load about 5 tons.
ii. With the divisional ammunition column, combined with the present M.T. column, the balance of the rounds required, in lorries.

As the gun-vectors under this scheme would carry as much ammunition as the present horse-drawn field battery, the ammunition

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vectors may seem an unjustifiable extravagance, but some at least are necessary to replace casualties and break-downs: possibly one per section instead of one per gun would suffice, spare gunners, etc. being carried in lorries.

9. There remains the question of the battery staff. Horses must obviously be taboo, unless three or four for the B.C., R.O., etc. could be carried in a motor float, which hardly seems practical; and a cross-country super-scooter is too fantastic to contemplate. On the other hand, reconnaissance on foot from a comfortable vehicle is apt to be perfunctory, and though a car and a proportion of motor cycles will no doubt be necessary for intercommunication and command on the line of march, their tactical utility is not great except in a country cobwebbed with roads and tracks. The only solution appears to be some form of whippet, or perhaps a pair, for the B.C. and R.O. and their parties, and an ammunition-vector, or possibly a spare gun-vector, for the bulk of the staff and all signalling gear including wireless. Each battery would also require one or more three-ton lorries for fitters and general stores, and for the balance of the personnel.

10. What has been said of the battery and its staff applies also to brigade headquarters, the transport arrangements of which need not be discussed in detail. There is however one question which has not yet been faced. What is to happen when this procession of ten-ton vehicles arrives at a five-ton bridge? One can only hope that the artillery vector will prove no less versatile than its prototype the Medium D tank, which is rumoured to go up anything, down anything, through anything, and to take to water like a duck: otherwise—an ignominious détour.

II. *Divisional Artillery of a Normal Division.*

1. The fundamental difference between this and the preceding case, from the point of view of artillery transport, it that there is in this no necessity to contemplate a greater road-speed than 5 m.p.h. combined perhaps with short bursts of up to 10 m.p.h. It is in fact the problem of direct substitution of mechanical for horse-draught that must be faced, and the possibilities of 'tow' as opposed to 'carry' that are now opened necessitate a complete review of the situation. This avenue of investigation it is not however proposed to explore, because, for various reasons which seem good to the writer, it promises to prove but a blind alley in the end. Briefly, his contention is:—

i. That the development of any really successful type of mechanical transport, to satisfy either 'super-mobile' or 'normal' conditions, is bound to be a slow process, attended by many set-backs.

ii. That the introduction of either vehicle into the service can be done only very gradually, owing to the many issues involved, as set forth in Part I.

iii. That the organization of one or two 'super-mobile' divisions, though not a thing of to-day or even of to-morrow, might, as regards the infantry, be carried out at short

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notice on any threat of war; since, except for the replacing of pack-mules, etc. by cross-country vehicles, it is a question not of design but of supply, and of trade supply at that—merely buses and lorries. Even for the mules an adequate substitute might be found, at least temporarily, in light agricultural tractors.

iv. That in consequence the 'normal' type of mechanical transport, before it has replaced any considerable number of horses, may be called upon to fulfil a rôle for which it was not designed and which it will be unable to carry out.

2. The advantages of concentrating all available energies, whether of money or of brains, on developing a single type of vector are too obvious to call for mention. That, gun for gun, the 'super-mobile' would be more costly that the 'normal' type is probable; but against this must be set the fact that the former satisfies all future conditions that can be foreseen, whereas the latter does not, and the difference in capital outlay can be written off as insurance against premature decay. Furthermore, until such time as lorry-carried infantry have to be accompanied, there will be no necessity to provide the expensive accessories of super-mobility—battery-staff whippets etc.—except to one or two batteries for experimental purposes; the remainder can retain a few riding horses, as the Medium T.D. batteries now do. Lastly, the disadvantages of having three distinct systems of draught for Light Artillery are manifest; and at least a proportion of batteries must continue to be horse-drawn until a type of vector suitable for any Eastern theatre has been devised, until the mobile workshops necessary for the maintenance of M.T. in an uncivilized country have been provided, and until India has either adopted the new system or made special arrangements for the recruiting of R.A. drivers—a concatenation of conditions that is hardly susceptible of early fulfilment, and that, even when it is fulfilled, will leave still unsolved the problem of affording guidance to the Territorial if not to the Dominions Forces.

III. *Medium Artillery.*

1. The ultimate ideal for the Medium is the same as that for the Light Artillery; the same road-speed, the same power of manœuvre across country. There seems little doubt therefore that the final solution of the problem of their mechanical transport will be the same also, and that the 60-prs. and 6-inch howitzers of the future will be carried on vectors on their existing carriages, suitably modified but perhaps without quite that capacity for mounted action which is essential for the lighter weapon. It is nevertheless by no means certain that it would be sound to experiment in this direction at the present moment; the similarity of the two problems makes it not unlikely that much money would be saved and in the end little time lost, if action on the Medium vector were deferred until a satisfactory Light vector has been evolved, in order that the experience gained in developing the one may be embodied in the initial stages of the other. Meanwhile however some temporary measure is desirable, since the present state of affairs is far from satisfactory.

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2. Although Medium Artillery need not necessarily be as mobile as Light, the system of towage by lorry can be justified only on the obviously dangerous assumption that any possible theatre of operations will be well provided with roads. Horse-drawn Medium batteries, while insuring against this risk, suffer from the fact that horse-draught is comparatively more extravagant for a Medium than for a Light battery, partly because the actual cost of heavy-draught horses is greater, partly because the horse does not in their case fulfil so many essential functions in the training of the unit, while at the same time absorbing an equal amount of energy in care and grooming. Moreover the hire of horses for Medium batteries of the Territorial Force is becoming increasingly difficult and expensive. For all these reasons therefore, the adoption of some form of tractor to replace the team is highly desirable, although the behaviour of the present service tractor is not encouraging.

3. It may be wondered that an intermediate course which has been rejected for the Light Artillery should be advocated for the Medium; but the conditions are not truly identical:—

i. Super-mobility for at least a portion of the Light Artillery may become essential at short notice: this can hardly be said at present of the Medium.

ii. In existing conditions, horse-draught Light batteries are reasonably satisfactory; Medium batteries, whether H.D. or F.W.D., or the present T.D., are not.

iii. No commercial vehicle is available to fulfil all the functions of the six-horse team of a Light battery; but a lorry can be improved upon and an eight-horse team at least approximately equalled by a ten-ton tractor now used by the trade and costing well under £1,000.

For Medium Artillery therefore the intermediate course appears to be justified, partly on account of its advantages both military and economic over the present state of affairs, partly on account of its ease of introduction, partly because it appears likely to fulfil essential military conditions for a far longer period than any similar compromise for Light Artillery could hope to do. If exhaustive trials of the tractor in question justify the hopes that are entertained of it, largely on the score of its use by the American Army during the latter stages of the War, the rate of its introduction into the service depends solely on the financial considerations of its provision and accommodation: but H.D. Medium batteries cannot altogether disappear at home until the general conditions are satisfied that govern the retention of a certain proportion of H.D. Light batteries, as set out above, except that the final complication of the non-regular forces does not arise—the T.F. being provided for and the Dominions Forces unaffected.

IV. *Horse Artillery.*

There are overwhelming sentimental objections to the adoption of mechanical transport by the R.H.A., nor has such a course any compensating military or economic advantage to offer in its defence. As long as cavalry remain cavalry, horse-drawn batteries can live

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with them; as long as horses can be found for them they can be found for their artillery also; and when—if ever—cavalry disappear or dying phœnix-like are reborn in the guise of galloping tanks, horse artillery must either disappear with them or follow them through their transmuting fire and share in their resurrection, no longer horse, no longer perhaps, in the present sense of the word, even artillery at all. It is held as one of the marks of a great statesman that even in normal times he confines his vision of the future to the span of a decade: it can be no reproach to a military essayist if he is still more modest in prophecy, and the horse artillery may be left undisturbed by direful prognostications as to their fatal and perfidious doom.

V. *'Special-Weapon' Batteries.*

1. It may safely be predicted that among the special characteristics of any future war between civilized nations will be an increasing prevalence of attacks from low-flying aeroplanes and of raids by fast-moving tanks, and convoys of mechanical transport will necessarily be peculiarly vulnerable to these sudden incursions. Widely dissimilar as these two phenomena are from every other point of view, as a target for artillery they differ in degree rather than in kind, and it seems not improbable that a weapon may be devised capable of combating them both. It is not a question of dealing with the first onslaught of enemy tanks, which is the business of the artillery in the line, whether specially sited for the purpose or in normal battery positions; nor one of protecting the fighting troops from machine-gun attack from the air—they have their own special responsibility for that, and their own special weapons, which one may hope will be improved; still less is it a question of replacing the ordinary anti-aircraft artillery, which lie altogether outside the scope of this essay: it is purely a matter of dealing both with tanks which have broken through the defensive zone, and with low-flying aircraft harrying defenceless convoys and vulnerable areas behind the lines.

2. In both cases, the necessary conditions which any defensive weapon must fulfil are:—

i. Power of rapid all-round traverse.
ii. Capacity for deflection for movement in two dimensions: essential even against a tank, when it is moving rapidly over undulating country.
iii. Power of rapid fire at low elevations.
iv. Adequate protection for the detachment.

To which may be added intense mobility, in order to head off or at least to follow up a successful raid of hostile tanks.

It may be objected that the only consideration that prevents existing anti-aircraft guns from filling this rôle is the danger of promiscuous low-trajectory fire behind the lines, but this is not altogether the case: a mounting designed for high-angle fire is inconveniently high for loading at low elevations, nor are the stresses set up the same; and as for the question of safety, enemy tanks and aircraft are no respectors of persons and there is only one nature of remedy for a desperate disease. It may be urged with more justice that the

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proposed weapon, which must obviously take the form of a shielded gun on a central pivot, mounted on a fast vector with an armoured cab, is itself hardly distinguishable from a tank; nor is such an accusation easy to refute. If however the gun and vector themselves, apart from details of mounting, armouring, etc., are identical with those of the super-mobile Light Artillery, and if, by having normal ranging-gear in addition to whatever devices are required for its special rôle, it is capable of taking its place in the line when called upon to do so, the proposed weapon may fairly claim to be a variant rather of the field-gun than of the tank; and as there seems no decisive reason against these conditions being fulfilled, the question of its organization will be considered in that light.

3. At first sight the obvious course is to brigade these special units together, using them as the equivalent of an Army Field Artillery brigade to accompany the super-mobile divisions; but although this solution has much in its favour, there is an alternative which cannot lightly be dismissed. It is hardly to be gainsaid that the super-mobile division is most vulnerable to the species of attack in question, not when it is in action and to some extent capable of defending itself but when it is on the line of march, being in the latter case essentially nothing but a glorified procession of mechanical transport, the bulk of it lorries or buses incapable of leaving the road; a long straggling procession moreover, for lorries at speed cannot travel nose to croup. In these circumstances, the special protective units must necessarily be so widely sundered that no probable improvements in wireless will enable a single individual, i.e. their brigade commander, to exercise any effective supervision; and, in view of the strictly analogous reasons which caused the 4·5-inch howitzers to be brigaded with the 18-prs. instead of by themselves, it is at least arguable that the same course should be followed by the 'special weapon' batteries. If this were done, the Super-Mobile brigade of Light Artillery would consist of two 18-pr. batteries, one battery of 4·5-inch howitzers, and one of 'special' 18-prs. to afford protection on the march, to fill what almost amounts to the rôle of a rearguard in action, and to form a mobile—a super-mobile—reserve. There the question must be allowed to rest; experience alone can indicate which of the two alternatives propounded is the more suitable for adoption, if indeed it does not offer a third solution as yet unperceived.

VI. *Lions in the Path.*

1. The whole life of the Mounted Branches has hitherto been so centred in the horse that the introduction of mechanical transport is certain to be bitterly opposed, and not without reason. Where training, discipline and initiative have so long been inculcated mainly by horse-management, it is natural that many should distrust their powers of making bricks without stable-straw. There is no arguing against an *idée fixe*, but the wisdom of Bacon may win over the waverers—"All this is true, if time stood still; which contrariwise moveth so round, that a froward retention of custom is as turbulent as an innovation; and they that reverence too much old times are but a scorn to the new."

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2. The drivers will be no less difficult than the officers, though in a different way. That the M.T. personnel should belong to the Royal Regiment and not to some other corps was amply demonstrated in France, where the pertinent lessons to be drawn from the fiasco of the Corps of Gunner-Drivers were unhappily ignored. But their pay presents a knotty problem. Skilled labour that has a commercial value must be paid at market rates if it is to be adequately recruited, and, apart from questions of expense, no unit could be a very happy family if the non-combatant were paid at much higher rates than the combatant ranks. If on the other hand drivers were recruited unskilled and trained by the Army, they could subsequently find employment as mechanics in civil life only if existing Trades Union rules were relaxed, and the fruits of their training might be lost both to themselves and to the nation. One can only hope of this, as of the thousand-and-one other conundrums that will inevitably arise—'solvitur ambulando.'

VII. *Conclusion.*

1. "I think," said Sidonia, "that there is no error so vulgar as to believe that revolutions are occasioned by economical causes. They come in, doubtless, very often to precipitate a catastrophe; very rarely do they occasion one."[1] As with States, so with Armies—and the problem under discussion is in all conscience revolutionary enough. The growing scarcity of horseflesh, the increasing cost of buying, hiring, feeding and maintaining horses, these are common knowledge; but they are predisposing, not decisive, causes. So great a change can be justified only by improved military efficiency, and the aim of this essay is to show how that improvement may be secured without seriously running counter to the more vital of extraneous conditions; for 'economical causes,' if they cannot be permitted to occasion a catastrophe, must at least be given credit for guiding and determining its course. Nor can the human factor be neglected. If the available talent of the country is to be brought into play, a programme not only of experiment but of provision also must be laid down: the spur of fame is not always the last infirmity of commercial mind, and the prospect of bulk orders, like any other carrot, loses its virtue if it is too remote.

2. Prophecy is at best an ungrateful and perilous pursuit, but prophets are necessary evils, if only to set up false gods for others to follow after. As the idols are approached their feet of clay become apparent, and other prophets, other gods succeed them; but without them there might perhaps have been no progress made at all. It is in this spirit that the project of the Super-Mobile Division is advanced, not as a final answer to the problem of mechanical transport but as a definite and not too distant stage in its solution. No man may see the end of the matter, but in the multitude of counsellors there is safety: and it behoves us all to—

'Ponder our voyage; for no narrow frith
We have to cross.'

[1] Disraeli, "Coningsby."

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APPENDIX.

The Liquid-fuel Resources of the Empire.

1. The main Imperial sources of petroleum in the future appear likely to be :—

i. The Mackenzie River district of Canada : reported to be 'the largest oil region in the Empire, comparable with Mexico; quite possibly the largest in the world.' It was prospected in 1920, and the only well sunk gave an average flow of 1,000 barrels per day of a paraffin-base oil containing a high percentage of petrol. Extensive operations are to be carried out this year, but transport is naturally difficult, and it is a great military disadvantage that the only possible site for an ice-free pipe-line port is in United States territory, i.e. in the coastal strip of Alaska.

ii. The South-West Persian oilfield, now included in the mandated territory of Mesopotamia; presumably the ratification of the Anglo-Persian convention by the Mejliss is only a matter of time—and of form also. The projected pipe-line and railway from Basra to Haifa will greatly quicken and cheapen transit to the United Kingdom and avoid the submarine perils of the Red Sea and the Straits of Ormuz.

iii. The Mosul oilfield is probably too exposed to be counted on with certainty in time of War.

iv. Oil prospects in British Somaliland are sufficiently promising to have induced a reversal of the proposal to hand that protectorate over to Italy.

v. There are understood to be considerable possibilities of further development in the West Indies, notably in Trinidad.

vi. There are still hopes in England itself; the deepest well so far sunk (January 1921) is only 3,000 ft., as against many of over 7,000 feet in Silesia and the United States.

vii. It is common knowledge that most of the oil interests in Mexico are in British hands: it is perhaps less widely realized that the Mexican output is rapidly overtaking that of the United States, which is on the decline—whether as a matter of natural exhaustion or of policy it is not easy to say. It is however obvious that implicit reliance cannot be placed on this source of supply in time of war, useful though it may be in building up reserves in time of peace.

There are of course many other possible oilfields within the Empire, some tentatively tapped, others as yet unprospected; but oilfields however rich take time to develope, and counting chickens is proverbially rash.

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2. The chief possible substitutes for petrol appear to be :—

i. A distillation from West African vegetation, whether a form of oil or of alcohol is not clear. The whole subject is wrapped in mystery, but it is understood that while laboratory experiments, official and unofficial, have proved fairly satisfactory, production on a commercial scale is not yet even in sight.

ii. Coal-tar extracts : not very helpful from a military point of view, except in so far as the coal released by the conversion of the Navy, and to an increasing extent of the Mercantile Marine, to oil fuel, may be used to relieve the shortage of petroleum. But it is so to say a paper transaction, opening no fresh sources of the supply of energy.

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MECHANICAL TRACTION versus HORSES.

Together with some suggestions for suitable types of Artillery in the future.

(Being the substance of a Lecture delivered before the Gunnery Staff Course, at the School of Artillery, 15th March, 1921.)

BY BREVET MAJOR R. CROFTON, M.C., R.G.A.

IN dealing with this subject I have left the question of railway transport and guns on railway mountings out of my calculations altogether.

The experience on which my discussion is based was gained, so far as active service is concerned, on the Salonika Front between 1916 and the armistice with Turkey in October 1918. It is rather surprising that, although in that campaign horses had frequently to be employed to take siege batteries into positions where their own tractors and lorries could not go, yet the general conclusion which I arrived at was in favour of mechanical traction, provided certain improvements can be made as regards its form and organization.

The opportunities which actually occurred in that theatre of operations of making an unbiassed comparison between the two methods of traction were many in number and varied in detail.

It is interesting to observe that the subject of mechanical traction has obtained official recognition in the provisional edition of *Artillery Training* issued last year.

I propose to subdivide my subject under three headings: I. *The Past*, in which the horse has held undisputed sway since the first appearance of artillery itself; II. *The Present*, under which heading I propose to produce arguments both for and against mechanical traction; since both mechanical and horse traction are still to be met with; and III. *The Future*, in which I shall attempt to show that the horse will be completely ousted by mechanical traction, though of a much more advanced type than anything that we have yet seen.

I. PAST.

Let us first consider the state of affairs as it was at the outbreak of the Great European War of 1914—1918. The last war of any magnitude, in which we had been engaged, was the Boer War of 1899—1902. In the twelve years which intervened between the signature of Peace after that war and the outbreak of the European War, enormous strides had been made with mechanical traction as a practical commercial proposition.

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Mechanical transport was unknown in the Boer War, but began to be mooted and subsequently employed for military purposes soon after its conclusion. Its use was, however, confined to the M.T. supply companies of the A.S.C.

At the very outset of the war, the importance of this mode of traction and transport was recognised and the military authorities immediately had recourse to "requisitioning", which is invariably and inevitably our method of finding the means of transport in the early stages of a war. Motor vehicles of every sort were made use of, both for carrying personnel, stores and supplies, and for drawing loads.

With an army such as ours, which is compelled to effect an immense expansion on the outbreak of war, we are almost entirely dependent upon civilian peace-time modes of transport to supply our needs in war. Consequently, if the prevalent mode of transport and traction in peace is mechanical then the army must follow this lead in war.

This dependence is exemplified if we recall the supply of London bus horses to batteries and transport vehicles during the South African War: many of these horses, it has been reliably reported, would not start until they heard the customary "Right behind," accompanied by two stamps on the footboard of the limber! At the outset of the Great War in 1914, the buses themselves were requisitioned, pained service-colour, and employed for the rapid conveyance of reinforcements to the battle area.

We have only to consider the amazing change that has come over the streets of London, as illustrated on the cover of the *Strand Magazine*, during the past twenty years, to realize that the days of horse draught are numbered so far as civilian traffic is concerned. We now see "taxis", which have entirely ousted the once familiar hansom and "growler"; motor-buses in place of horse-buses electric trams, lorries, motor-cycles and so forth in great and ever increasing numbers whilst the horse-drawn vehicle is being altogether given up.

In spite, however, of this transition at home we were able to supply ourselves with a sufficiency of horse flesh throughout the war by calling on the resources of distant countries, such as Canada, South America and Australia. It seems probable that we shall be able to do this for many decades to come provided always that time, the governing factor in war, will permit.

A ready sale was found for all the horses that the Government had to dispose of after the war, showing that the supply does not yet exceed the demand.

In treating of the introduction of mechanical traction into warfare, certain limitations must be acknowledged and allowed for. In certain wild and uncivilized countries, where mountains, great forests, sand deserts and such features predominate, the four-footed animal, be it mule, horse, or camel, will continue to be as necessary as at the present day. The arguments which I shall adduce in favour of the introduction of mechanical traction apply with their full force only in a war on a large scale, fought over civilized country.

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The first difficulty with which most of us who served with horsed units during the war were faced was that, with the passing of the horse in commercial life, the number of men with a knowledge of horses has dwindled in an astonishing manner. Here again we are almost entirely dependent upon the civilian element, since the professio soldier can only form the nucleus of the national army, required in a war of the first magnitude. Not only was it difficult to find men who possessed any experience with horses; but a great aversion to mounted duties generally was to be remarked. Where there is no enthusiasm for, or love of, horses; their care becomes drudgery and the rôle of the mounted man, whose first duty is to his horse, is most unpopular. This spirit is readily understood when it is realized that a mounted man finds himself working much longer hours than his more fortunate friend among the gun-numbers—and at work which to a man with no taste for horses is a particularly unpleasant form of "fatigue".

The rising generation, as a whole exhibits a far greater enthusiasm for machinery than for horse-flesh.

In the original "Heavy" Batteries of the war, (60-pr. and 4·7-in guns) this shortcoming amongst recruits was further aggravated by the fact that very few officers and practically no senior N.C.Os (the majority of whom came from coast defence) possessed any considerable knowledge of horsemastership: in fact some of the senior N.C.Os were safer away from the horse-lines; since their spirit of "passive resistance" to horses might infect their juniors.

It is possible that a better selection might have been made as regards the men originally sent to horsed units. Had all men with knowledge of horses been so described from the time of their attestation, much heartburning would certainly have been avoided. Here, again, the R.G.A. was at a great disadvantage, since in the early days of the war no man of the R.G.A. was shown as a driver. All were "gunners", some being "employed as drivers"; consequently there was no guarantee that a heavy battery driver, after being carefully trained, would not find his way, through a Base Depôt, into a siege battery where his entire mounted training would be wasted.

II. PRESENT.

I shall now proceed to mention some points, in which mechanical traction holds the advantage.

Undoubtedly one of the deciding factors in a war such as we have now come to regard as normal—that is one in which the whole nation is involved—is the question of economy of man-power. Every able-bodied man who cannot be spared for the front line is a loss to his side; and that side which can put most men into the front line and go on putting in men after its opponent has begun to draw in his horns will, *ceteris paribus* gain the day. Towards the close of the Great War our man-power began to give out, a fact which we attempted to conceal by reducing the establishment of an Infantry Brigade from four battalions to three, thus preserving the number of British Divisions in the Field.

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Now it is immediately evident that whereas, when horse traction is employed, one man can control only 2 horse-power in draught; with mechanical traction the same man is able to control a very largely increased power, say 40 H.P.

Further, with a horse-drawn unit the men must either march (in the case of medium artillery) or ride on vehicles (in field artillery) or on horses (with horse artillery). Any of these methods is tiring and, in time and under unfavourable conditions, is bound to become exhausing. On their arrival at a halting place the men will probably have to sleep either in the open or under bivouacs. It may be said that these conditions are "hardening" and so they are for the trained soldier; but many men of a *national* army, who would otherwise be of value, will be found to collapse under such conditions and to become an incubus to their side; merely helping to fill up hospitals which are primarily intended for the wounded.

Compare the conditions under which a mechanically-drawn battery marches. The men themselves, their kits, rations, and cooking utensils are all carried in lorries, which can serve them also for sleeping accommodation when weather conditions are bad. Since it is evidently advantageous to get the fighting man to his battle position in the best possible fettle, all combatants must be made to take advantage of any available means of transport.

We have also to consider the fuel required to keep our mechanical vehicles on the road and to compare it with the forage consumed by the horse. I think it will be agreed that the balance of efficiency is with the former, since it is lighter, less bulky, and possessed of better keeping qualities than a corresponding "horse-power-worth" of forage. We know too that horses require a number of complicated trappings in the way of harness and saddlery, which again are heavy, bulky and perishable; requiring constant care and attention both with units and in store. All this is dispensed with when we resort to mechanical traction.

To keep horses in good condition—and it is essential that they should be kept in prime condition at all times on service, more particularly when things appear to be at a standstill—the greatest care is necessary in adhering to a regular stable routine, with watering, feeding and exercise at fixed hours so far as the situation will permit. Regular and good shoeing also is of the utmost importance and spare shoes must always be available. M.T. vehicles on the other hand, though they require periodically to be overhauled, lubricated and generally kept in good running order, are not tied down to routine hours, nor do they require to be exercised when not in use. If a heavy ammunition fatigue is required in the lorry lines at any time, the lorries can be left and all men turned on to it without prejudice to the condition of the lorries. This is impossible in horse-lines, even out of stable hours.

Again we find the horse requiring far more attention on the line of march than the lorry or other M.T. vehicle the latter needing merely an inspection of bolts and bearings, filling up with petrol, etc., operations requiring far less time than the lengthy and tedious

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ones of watering and feeding, with all the attendant duties which are apt to be scamped by some drivers, unless watched with a lynx-eye.

Considering the two means of traction on a road, we are bound to notice that mechanical is far more compact than horse traction. The space occupied per horse-power on a road works out at about ten to one in favour of the former, if we consider that with horse-draught an 8-horse team and gun occupies 25 yards in column of route, whereas an F.W.D. Lorry (of 40 H.P.) and its gun would take up about half this space.

If we now pass to a comparison of the two modes of traction under fire, it must be acknowledged that a vehicle with a team of horses affords an easier and more vulnerable target, either for artillery or machine-gun fire, than the corresponding mechanically drawn or propelled vehicle. It is certainly true that a lorry or tractor, if rendered *hors de combat*, will cause a worse block in the traffic, but it is practically affected only by a direct hit. On the one hand, a team may be stopped and probably destroyed in detail, by one horse or driver being struck by a splinter of shell; whilst on the other, adequate protection against splinters may be given to both power and driver. The same is true of an attack by bombing or machine-gunning from the air, a form of attack which is likely to become more and more common in the future.

We must allow also for the fact that the element of panic or fear amongst the team of horses, may have serious consequences. In considering this, it may not be out of place to put forward a plea for the horse itself. It seems only right that he should be spared the horrors of war, provided an efficient substitute is forthcoming. No lover of dumb animals would wish to compel a horse to suffer the dangers and discomforts of a war which is no concern nor affair of his. Why then should we not leave him at home and fight out our quarrels amongst ourselves?

I now come to two points of advantage held by mechanical traction as compared more particularly with the heavy draught horses employed by medium horse-drawn batteries (60-prs. and 6-in. howitzers).

In the first place such horses are difficult to get, since to withdraw them from commercial uses at home must go far towards crippling important industries. Then the question of their initial cost is a serious item—this point applies in a minor degree also in regard to all horse as against mechanical traction: since evidently the initial cost per horse-power is greater with the former than with the latter. But a more potent objection to the use of heavy draught horses on service is their extreme delicacy. This is due to the fact that under peace conditions they are kept in warm stables and pampered in many ways to keep up their condition and the bulk upon which their usefulness depends. Put them on lines in the open and keep them there in all weathers, and many of the best of them will fall away and begin to ail, in spite of all that one can do for them.

Such horses too require a greatly increased issue of forage and a far greater quantity of water daily than the light draught horse. To keep up their bulk, chaff or grazing is essential; so that

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their value on a long march is very much discounted. The actual quantity of water consumed by a H.D. horse in full work has been found by experience to average eighteen gallons per day—and he must have it, or he will not be able to pull his weight.

In peace time, the height standard for R.G.A. recruits was greater than for the R.H. or R.F.A., with the result that a bigger stamp of man was forthcoming from which to select our drivers. Under war conditions, however, this difference soon vanished and we often had to carry on with R.F.A. drivers. These men were not of the required physique either to groom or to ride and drive H.D. horses, even when there was no shortage of personnel. The result of insufficient attention in stables was soon evident in the appearance of diseases, such as mange, ringworm and biliary fever. Though sometimes units were to blame for this state of things, there is a limit beyond which even extra work and skilled knowledge cannot make up for unsuitable and inadequate personnel. This sickness filled the veterinary hospitals and increased work and congestion on the lines of communication at the best; or at the worst meant total loss of valuable horse-flesh, with consequent expense and difficulty in replacement.

Another respect in which the heavy-draught horse proved unsuitable for army conditions, was in the method of driving adopted. Many of the horses were evidently quite unable to accustom themselves to the man on their backs and very often no amount of persuasion on the part of a partially-trained driver could induce them to conform to his wishes. This was particularly noticeable when it was a question of "starting a weight." Neither drivers nor horses could be induced, as a rule, to understand the necessity for all horses coming into the collar together; with disastrous results and the usual recourse to drag-ropes and detachments to assist. At one time, during a lull in operations, heavy batteries in the 16th Corps used to supply horses for ploughing the Corps gardens: the difference in the way the horses worked then was most noticeable. They knew all about *that* work.

I can perhaps best explain my point as to the difficulties experienced with heavy draught horses as against mechanical traction by recounting an incident of the advance of the 16th Corps following on the general retreat of the Bulgarian Army in September 1918. The original Corps H.A. in that advance consisted of two Heavy batteries (60-prs.) with, of course, their ammunition columns. The pace soon proved too hot for them and this, combined with the shortage of water and forage, necessitated leaving them behind altogether, after they had covered some eighty miles, and sending back for a mechanically drawn Siege (6-in. how.) battery instead. This battery, travelling by road, came through from Salonika, across Bulgaria to Mustapha Pasha on the Bulgaro-Turkish frontier, a distance of at least three hundred miles, complete with men, kits, rations and ammunition, in eight days. It is true that the bridges suffered considerably from their passage—a fact which was duly impressed upon us by the R.E.—but that is a drawback to the use of *wheeled* mechanical traction, which I shall attempt to dispose of in my later suggestions.

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I now come to my eighth and last point in favour of mechanical traction, and that is the pace at which it is able to travel. The conditions in this respect are somewhat prejudiced at present, however, by the fact that the pace of mechanically drawn artillery over roads is limited by the danger of damage to the carriages, which are in the majority of cases unsprung and consequently liable to damage from fast travelling with the resultant jolting. Even so, I would say that a mechanically-drawn battery is well able to do an average of three to four miles per hour, or forty miles per day; whereas I would not guarantee more than two and a half to three miles per hour and twenty miles per day in the case of a horse-drawn medium battery. The difference is largely accounted for by the constant halts necessary to attend to the horses. There comes to my memory a case in which my guns were taken from me and handed over to the care of some very capable French Latil tractors for a quick move by road. They covered forty miles in some four hours certainly, but there was hardly a bolt or rivet that had not its tale to tell at the other end!

I hope to be able to show that, at no very far distant date, it will be possible to attain a speed of twenty to twenty-five miles per hour with guns mounted in tanks.

I come now to the consideration of certain points which under *existing* conditions, are *against* mechanical traction. I shall attempt at the same time, in order to strengthen my argument, to indicate means by which these disadvantages may be minimised.

In the first place, there can be little doubt that the conditions surrounding a horsed unit engender a spirit of keenness, smartness, and *esprit de corps*, which is sometimes noticeably lacking in a mechanically-drawn unit: since this latter has not so much to interest it and to occupy its time. Such a state of things is, of course, more particularly liable to arise under peace-time conditions. Again, the fitness and general sporting instincts of the men will usually be found to benefit under the healthy routine necessary to the care of horses. I think that much can be done to clear away this apparent tendency to "slack off" by care on the part of the officers, who should inaugurate and support games and other healthy pursuits in the men's spare time and cultivate a very high standard of training, on infantry lines, during parade hours.

A second point, where horse-drawn artillery holds an advantage over its M.T. brother, is in the matter of cutting up of roads. The effect of this can be realised when we consider the legislation, culminating in the new horse-power tax, which has been necessary to meet the cost of maintaining the roads at home since motor traffic has become so common. Further, we have seen that in the event of a breakdown to a mechanically-propelled vehicle, the block caused in the fairway is more serious and takes longer to remove than that caused by a horse-drawn vehicle. And we have also seen the damage which motor tractors are apt to cause to road bridges and culverts.

Under existing conditions and employing wheeled vehicles, we may say that horse-drawn vehicles are better able to leave the roads and to go across country than M.T. vehicles.

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I shall hope to show that both these disadvantages will be disposed of ultimately, however, by resorting to the tank or other form of cross-country tractor.

A very serious objection to all forms of mechanical traction known at present is the noise which they make, which is such as to render them impracticable for use anywhere in the vicinity of the enemy if secrecy is essential, more particularly at night when the air is still and sound carries farther. It may be possible sometimes to drown the noise by heavy firing or by a concentration of aeroplanes, but it is quite conceivable that such a ruse might not fit in with the plans of the commander.

There is another advantage held by horse draught at present, but it appears to me one which is largely ephemeral, and that is facility of transportation, both by sea and land. It certainly takes longer to load a lorry on to a railway truck than it does a gun and a team of well trained horses, more particularly if end-loading is not available. And when employing a heavy tractor this is still more remarkable, since special trucks are then necessary. In loading on to ship-board the objection is not so overwhelming, particularly as it is generally possible to strip down the M.T. vehicle and thus to distribute its weight. In this latter case of transport by sea, the horse, though he is comparatively easy to put on board, requires constant care and attention on the voyage, more particularly in a hot climate.

Finally, as we have seen, it is not contemplated ever to abandon the use of the horse and mule for warfare in savage and uncivilized countries. Pack artillery has indeed an advantage over any form of traction in its power to escape observation by moving under cover in nullahs, etc. well away from roads and all remarkable features. There are many occasions when the use of pack transport will be found of the greatest assistance: it was used for instance during the Salonika campaign to carry ammunition for 60-prs. and 6-in. hows. by short routes to positions which were almost inaccessible to wheels.

I think then, considering these various points for and against mechanical traction for artillery, that we may fairly say that the advantage, even under existing conditions, lies with the mechanical device, at any rate in the case of medium artillery.

If we bring into our calculations the relative value of the wheel, which cannot distribute the weight on it, and the caterpillar "track" the advantage is overwhelmingly with the latter, since it can cross country that is inaccessible to any form of wheeled vehicle.

My proposal is, therefore, to bring in at once mechanical traction, employing the caterpillar "track," for all forms of medium artillery; and, when the time comes, to introduce a similar mode of traction gradually into Field Artillery, beginning with the Divisional Ammunition Column and working forward to the Brigade itself.

III. FUTURE.

We come now to consider the Future, in which mechanical traction holds the field, and with it the second portion of my subject, which is: "Suggestions for suitable types of artillery."

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It must first be stipulated that the mechanical means of traction employed by the Royal Artillery shall be entirely under the control of the Regiment. There must be no divided control. To allow our means of draught to remain under the R.A.S.C. would be as unsound as it would be, say, to allow the horses of our present teams to be run by the Remount Department or to go back to the earliest days of artillery with the field army, when the teams and drivers were supplied by civilian contract. The necessary M.T. for his battery must be placed under the orders of the Battery Commander and it must consist of R.A. personnel, both officers and men. It would be possible to have a repair workshop with Brigade Headquarters and a workshop officer, who would be a specialist, probably from the R.A.S.C., attached to Brigade Headquarters, in much the same way that the medical, veterinary, and signal officers are now. Periodical inspections by senior officers of M.T. would take place.

Before passing on to the more distant future, it would be well to make one more stipulation regarding the employment of the mechanical transport of Batteries, though in all probability this would follow as a natural consequence of its removal from outside control. I refer to the necessity of keeping the F.W.D. lorries (or tractors) and the firing-battery lorries always at the disposal of batteries, even though this may entail leaving them empty and unemployed at a time when transport is urgently required elsewhere. The inclusion of these vehicles in any form of Transport "pool" would be most dangerous, as it might easily result in the battery finding itself immobile on the development of an unfavourable situation.

To glance now at some of the possible future developments of artillery. It appears to me that the four-wheel drive lorry, the traction engine, and the caterpillar tractor will all eventually be superseded by some form of tank. As to whether the guns will be mounted inside, or drawn by, these tanks; opinions will probably be found to differ. Since tanks already mount guns of light calibre (3 and 6-pr.) I am inclined to think that the time is not so very far distant when the 18-pr., or its successor as a field gun, will be mounted inside a swiftly-moving tank. It would seem possible that such a tank, to weigh a maximum of, say, 10 tons, could be constructed even now; the gun inside it being mounted in such a way that it could either fire (all round, and upwards against aircraft) from the tank or be removed from the tank, mounted on wheels (which would be carried with it), and fired from outside. A speed of 20—25 miles per hour should be attainable. The gun detachment and an echelon of ammunition would be carried, either in the gun tank or in a firing battery tank. Personally I am in favour of having them in the same tank with the gun. The 4·5-in. howitzer, if it survives, would be similarly treated.

At any rate to begin with, the heavier natures of guns and howitzers (provided these latter are not swallowed up by further developments of the gun-howitzer) will probably be mounted on suitably sprung carriages, and drawn behind larger tanks which will carry their detachments and ammunition, and be armed with machine guns to enable them to form an escort to the guns. At a still later date, I foresee guns of varying calibres and greatly in-

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creased power mounted inside tanks of all sizes, converting them into the veritable "land cruisers," to which tanks were likened when they first burst upon us during the Great War. Supplies and personnel, both of artillery and infantry, would then be carried in similar heavily-armoured vehicles. Existing Battery formations would gradually disappear, being unsuitable for tactics approximating to those of the Navy.

This is not more fantastic than the suggestion would have sounded in pre-war days, that in four year's time submarines, each carrying a 12-inch gun, would be seen. The tendency is, in fact, to put an end to the stagnation of trench-warfare and to devise means of returning to a war of movement. The heavily armoured tank, mounting artillery, seems to be the logical answer to entrenchments and barbed wire. It is held by some that the tank is checkmated already by the land-mine. But I consider that this will prove much less effective than the sea-mine in naval warfare which has failed to kill the cruiser; since no army dare sow mines in ground which it may possibly have to make use of itself.

In this future war, concealment and camouflage will be largely abandoned in favour of rapidity of manœuvre which—combined with the hypothetical flashless and soundless gun of those days—will afford much better protection against the attentions of hostile aircraft. Tanks have already been designed to be gasproof and amphibious, so that two possible objections to my prophecies are removed. At rest, tanks will be protected by camouflage, as at present.

The question of the control of this fleet of tanks is likely to become a vexed one, causing much heart-burning and calling for the exercise of great tact on the part of the Army Council of that day. Either the Tank Corps will swallow the Royal Regiment or vice versa! We can only hope that, being the senior arm, our claims will prevail.

I will close my lecture by quoting in support of my prognostications, a passage written by Colonel J. F. C. Fuller, D.S.O. who was Chief General Staff Officer of the Tank Corps in France during the Great War. He says:—

"To-day we stand upon the threshold of a new epoch in War. The earth has become a universal vehicle of motion, like the sea. To pit an overland, mechanical army against one relying on roads, rails and muscular energy is to pit a fleet of modern battleships against one of wind-driven three-deckers. The result of such action is not even within the possibility of doubt; the latter will for a certainty be destroyed, for the higher form of machinery must win, because it saves time, and time is the controlling factor on the battlefield, as in the workshop."

Whether this is true or not is for the future to decide; but he would be a bold man who would dispute its logic.

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NOTES ON THE CO-OPERATION OF THE INFANTRY AND ARTILLERY OF A DIVISION.

BY COLONEL H. W. NEWCOME, C.M.G., D.S.O.

"*Artillery cannot ensure decisive success in battle by its own destructive action. It is the advance of the infantry that alone is capable of producing this result.*" (Artillery Training 1921 Vol. III. para. 13).

THIS must be constantly borne in mind by the artillery, and the infantry must realise that under modern conditions they will be unable to maintain their mobility and offensive power without undue loss unless their artillery support is effective. An infantry officer recently put the thing in a nutshell when he said that he liked to fight two to one, i.e. with his infantry and artillery against the enemy's infantry. The ideal to aim at is that our infantry should receive the support of their own artillery in the fight and that the enemy's artillery should be unable to help their infantry.

This ideal cannot always be attained, but our object should be to get as near to it as possible and for this the closest co-operation between infantry and artillery is essential. Now it "takes two to co-operate" and each party must do its share. We want to consider the respective duties of the infantry, the artillery, and the commander of the force.

The commanders responsibility.

Every plan for attack or defence must be considered from both the artillery and the infantry points of view. The requirements of the two arms are often conflicting, and to make the plan to suit one arm and tell the other to conform does not always result in the most suitable combination of the two. At tactical exercises, the solution often offered is that the infantry will attack over certain ground or take up a certain defensive position and that "the artillery will co-operate," regardless of the fact that efficient artillery support would be very problematical under those particular circumstances. The various methods of carrying out any tactical operation should be discussed by the infantry and artillery commanders concerned, and it then rests with the commander of the force to decide how much weight should be given to the capabilities of each arm and to settle the final plan.

The artillery share.

The primary objects of artillery fire are :—(i) to assist the movements of our own infantry. (ii) to prevent the movements of the enemy's infantry (Artillery Training 1921. Vol. III. para. 13). It is

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therefore the duty of the artillery to ascertain the progress and needs of the infantry and to give them such support as they require. To enable them to carry out these duties they must have (i) good observation (ii) good communications (iii) good information. Artillery Training 1921 lays great stress on the importance of good observation in all the stages of attack and defence, and this implies good communication between the battery commander at his observation station and his battery. Otherwise he will find himself in the unfortunate position of the officer who, during the retreat from Mons in August 1914, saw a German battery with its wagons moving across his front at easy range, and could not fire a round because his telephone line had been cut. We must therefore consider observation and communications together, as one is no use without the other.

Increased facilities may be provided in the future for observation from the air and the more universal introduction of wireless telephony may simplify the question of communications, but in the meantime the artillery is largely dependent upon ground O.P's and the telephone line or visual signalling. Commanding ground is usually necessary for the first and short distances for the second, so the original selection of ground for attack or defence is an important factor in considering the question of effective artillery support.

In any defensive position there is usually one portion of the ground which gives a more or less extensive view over the scene of the proposed operation; the principle O.P's and the guns for the defence of the main battle position should be in this area. Telephone lines may then be short and quickly repaired or visual signalling may be resorted to. If the majority of the O.P's are in or near the front line; observation becomes difficult and intermittent owing to the enemy's fire; if a large proportion of the guns are placed near the front line they get in the way of the infantry and are apt to be overwhelmed by the enemy's artillery; it follows that, from the artillery point of view, the infantry should occupy the ground for at least three thousand yards in front of the main artillery position on the high ground, in order to allow of sufficient depth in the distribution of the guns and to secure efficient artillery fire. And from the infantry point of view this appears to be the best arrangement. Although they may be faced with difficulties of supply, carrying out of reliefs, positions for supports and reserves etc. in the forward positions, they can usually find better ready-made obstacles in the lower ground and are better screened from the enemy's O.P's and artillery fire. Infantry on the forward slope of high ground make a good target for the enemy's artillery; if they are withdrawn behind the crest, distant observation is impossible and the artillery is very seriously handicapped.

A good example of the advantages of the forward position of the infantry is the holding of the line of the river Ancre by the Third Army in March and April 1918. The O.P's were on the hills north of the river where they had excellent observation over the north side of the Peninsula between the Ancre and the Somme, and the guns were close to the O.P's. The line of the Ancre was held by the infantry where they had the river and marshes in front of them, and where

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the enemy's artillery had great difficulty in locating them. Various hostile attacks were nipped in the bud as they attempted to deploy from the crest of the hill, and our infantry, weak as they were, had no difficulty in dealing with those which reached the river bank. In fact the principle of two to one was largely obtained in this case.

In the attack the same general principles hold good. The guns must be near good O.P's, but in this case they should be close up to the infantry so as to cover the advance as far as possible without change of position. Even in open warfare a time-table will often be necessary owing to the difficulties of observation. The objectives selected should be screened from the enemy's artillery, or our infantry will be shelled off the position, as occurred at Delville Wood. It was not until the attack was continued for one or two thousand yards beyond the edge that we succeeded in holding the wood permanently.

In addition to good observation and good communications brigade and battery commanders require good information both as to the general situation and the progress of the troops they are supporting. It is the duty of the C.R.A. of a Division to keep his brigade commanders in touch with the progress made by other divisions on their right and left. To help him do this brigade commanders must link themselves up with the main signal centres explained in Artillery Training 1921, Vol. III., para. 129.4 and the C.R.A. will also employ his staff officers and mounted orderlies; good information from the flanks should thus be secured.

To keep touch with the actual position of the troops in front is more difficult. First it is essential that the artillery brigade commander should be in close personal touch with the officer commanding the infantry whom he is supporting and obtain all available information from him. He should also be in a position to see what is going on from his O.P., and every opportunity must be seized by his battery commanders to keep him fully informed of events passing on their front. But it is often impossible to actually see from the O.P's what is going on, so the brigade commander should organize within the brigade a regular system of officers patrols, which should be given definite tasks and used to keep touch with the headquarters of battalions when required. In addition it will often be advisable for the divisional artillery headquarters to organize a special information party which should be sent out for the day and given a roving commission to gain information by any means which may suggest themselves; special arrangements will be required to enable this party to transmit the information obtained.

These are the principal means by which the artillery endeavour to gain the information necessary to enable them to support their infantry.

The infantry share.

The needs of the artillery and how far these needs can be met by a suitable selection of ground have been pointed out in the above paragraphs. It is the duty of the infantry concerned to meet these needs as far as they possibly can within the limits of the orders given to them. To be in a position to decide how far they can go in this

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direction, they must have a knowledge of the difficulties connected with the observation and control of artillery fire, and they will then realise also the disadvantages attending a change of plan at the last moment.

One very important point in this connection is the selection of infantry brigade headquarters and F.S.R. Vol. II. Sec. 107.7 puts this case very clearly. "To ensure that intimate co-operation between the infantry and their supporting artillery which is essential to success, it is necessary that their respective headquarters should, if possible, adjoin." The artillery brigade commander's choice is restricted as he must be near his batteries in order to control them, so the infantry brigade commander should, if possible, select his own headquarters in close proximity to those of the artillery. These latter are chosen with a view to observation, control, and communication with the division, so that the best positions for the two headquarters usually coincide.

But there is a further duty incumbent upon the infantry, and that is to keep the artillery constantly informed as to their whereabouts and difficulties. In the early days of the war attempts were made to carry out this duty for them by sending artillery liaison officers to battalion and even to company headquarters, but it was eventually found that the resources of artillery brigades were insufficient for this purpose. A liaison officer must have considerable experience before he can give useful advice to his infantry and must have good communication to his own unit to enable him to convey their requirements to the proper destination; the number of suitable officers, telephonists and linesmen was insufficient to keep the system working satisfactorily on this scale. In theatres of war where the infantry is distributed over a wide front and where the hostile artillery is not very powerful, these considerations may not apply equally; but in normal conditions of civilized warfare it is probable that "the subordinate artillery commander who has been allotted a task necessitating co-operation with a certain force of infantry" can afford only one liaison officer with signallers and orderlies. If the two headquarters cannot adjoin, this liaison officer must be at infantry headquarters (see Artillery Training 1921, Vol. III. 21.5.)

In normal conditions a large share of the infantry in co-operation consists in sending the necessary information back from their front line to their brigade headquarters, where it will be picked up by the artillery. To enable them to perform this duty efficiently, a certain knowledge of artillery methods and of practical gunnery is required by all infantry officers. Some of the points which they should study are :—

(i). Method of describing targets. The infantry and artillery must "Speak the same language" if they are to work together and any call for fire from the infantry must indicate clearly to the artillery where such fire is required. The clock code with some conspicuous reference point is the normal method of describing targets, but it is necessary that the observer's position should be stated. It has been suggested that the adoption of the aeroplane clock code would obviate this difficulty but this requires demonstration.

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(ii). Moving of guns. Constant change of position means loss of power, as a battery takes a considerable time (varying with the equipment) to limber up, get to a new position, range and get to effective fire. Artillery is powerless when on the move, so all positions should be selected with a view to covering an advance or retirement as long as possible without change of position.

(iii). Allotment of zones. Indiscriminate shooting by batteries over the battlefield may be fatal to effective fire. A German machine gun battery retiring from the Petit Morin in September 1914 escaped practically untouched in full view of the whole divisional artillery, the reason being that every battery commander started shooting simultaneously and no one officer could distinguish his own ranging rounds. Zones or tasks must be allotted to brigades and careful arrangements made for ranging if a concentration of fire is required.

(iv). Supply of ammunition. Except when time is available for the accumulation of a large reserve, the ammunition available with a battery is very limited, and large barrage or bombardment programmes are out of the question. Infantry officers should bear this in mind when calling for artillery fire. With heavier natures of guns, the weight of ammunition to be handled is also a serious item.

(v). Enfilade fire. This is very effective when it can be employed, but infantry officers must remember that their guns are not then behind them and that communications become long and difficult. They must keep to the programme as the artillery plan cannot be changed at short notice in the middle of the operation. The failure to realise this was the cause of the so called "short shooting" when the infantry wanted to pursue the enemy after the capture of Beaumont Hamel in November 1916.

(vi). Range of various weapons. The effective and maximum ranges of guns and howitzers are given in F.S.R. para. 12.4.

(vii). Effect of various natures of shell, shrapnel, high explosive gas, smoke, incendiary, etc.

(viii). 100% zone. A number of rounds fired from any gun or howitzer even under experimental conditions and with every round accurately layed, will not fall on one spot but will form an elongated pattern on the ground, the size of the pattern varying with the weapon and the range. The centre of the pattern is known as the mean point of impact (M.P.I.), 50% of the rounds falling in the vicinity of the M.P.I. In order to obtain effective fire, the M.P.I. must be on or near the target, and this means that a proportion of the rounds must fall short of the target, i.e. in the case of the enemy's front line trench, in "no man's land." Therefore, if our troops are too close to the proposed target, they must be withdrawn to a safe distance or the M.P.I. will probably be beyond the target and the fire be ineffective. The shape of the zone also shows the advantage of enfilade fire, especially in the case of a shrapnel barrage.

(ix). Mean point of burst of shrapnel. Infantry officers often used to ask why the artillery were ordered to have a certain percentage of bursts on graze. The reason is the same as in the case of the 100% zone, viz: that all fuzes at a given setting will not all burn for exactly the same time. 50% of the bursts will be near the mean point of burst (M.P.B.) but others will burst short or long of this point. The

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object of ordering a proportion of grazes is to elimate the short bursts, which are ineffective and tend to prevent the infantry from keeping close up to the covering artillery fire.

Conclusions.

Under present conditions the efficacy of artillery support is largely dependent upon the selection of suitable ground for O.P's and battery positions, with sufficient depth in front of this area. The requirements of the infantry and artillery are often conflicting and the relative importance of each arm in any operation is the main factor which must decide the question, always bearing in mind that it is the advance of the infantry which alone is capable of producing decisive success in battle.

It is the duty of the artillery to assist their infantry by every means in their power and to find out their needs by personal liaison, observation, patrols and information parties.

It is the duty of the infantry to make themselves acquainted with artillery requirements and to meet these requirements as far as they possibly can. They must also use every means of sending back to their artillery such information as may obtain for them the support which they require.

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OUR ARTILLERY IN ITALY.

BY MAJOR A. G. ROLLESTON, O.B.E., R.F.A.

THIS short sketch of the doings of our artillery in Italy will deal only with the period after the Caporetto disaster at the latter end of 1917; but it will be remembered that early in that year some 6-inch howitzer batteries had been sent to the Italian front. They did excellent service, which was much appreciated by our allies, and succeeded in withdrawing during the Caporetto retreat, after heroic efforts to stem the tide, without the loss of a single gun.

After this disaster it was decided to send a British and French force to the Italian front to encourage the morale and stiffen the resistance of our allies. Our troops received a wonderful welcome, and their presence encouraged the Italians to renewed efforts, which resulted in the successful defence of the southern bank of the Piave river, where the advance of the victorious Austrian and German armies was finally brought to rest.

The British force consisted of the 2nd Army (11th and 14th Corps) under General Plumer, which had just been through the terrific fighting at Paschendale in the autumn of 1917. The troops were delighted at the change of scene, and no small change it was from the mud and horror of the Paschendale Ridge to the vine-clad plains and glorious scenery of the Italian front.

The Montello Ridge.

The first position occupied by the British force was the Montello Ridge on the south bank of the Piave river. Shaped like a hog's back, it is about 8 miles long by two miles across. The concealment of battery positions was no easy matter owing to its bareness of trees and vegetation. Fortunately there were a number of small craters or pot-holes dotted about on the ridge, in some cases large enough to contain a 6 gun battery, and by the aid of these and skilful camouflage fair concealment was obtained.

The northern side of the ridge slopes abruptly down to the Piave river, our front line being established at the foot of the slope. The river bed is about half a mile wide, the amount of water and strength of current depending on the time of year. The Austrian front line was situated on the opposite bank.

Our 18-prs. had some difficulty in finding positions from which they could shell the enemy front line. The problem was to clear the crest from positions on a high plateau when firing with large angles of sight of depression. There were ways out of the difficulty: firstly, reduced charges which were not then available; secondly, placing guns right forward to fire at almost point-blank range, which would entail complete exposure of the positions; thirdly, placing guns right back to fire at long ranges, which entailed lengthy communications and loss of accuracy; and lastly, placing guns on the flank of their objective,

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enabling them to bring oblique and enfilade fire to bear on the Austrian front line and on the river bed, which constituted "No man's land." This necessitated batteries occupying positions outside their own infantry areas, and consequently added to difficulties of liaison and communication, but was finally decided upon as offering the best solution of the problem.

The strength or weakness of this position was never really put to the test while we were in occupation, for peace and quiet reigned; and it was a blessed period of rest and convalescence for the war-worn troops of the 2nd Army.

Meanwhile there was much activity behind the lines. Batteries and regiments vied with one another in smartness of turnout, discipline, and efficiency; and all ranks were determined to show the troops and civilians of a foreign nation, who had not previously seen them at work, what the British Army could do.

Army schools, which had proved so successful in France, were formed in January, 1918, partly with the object of keeping up the standard of knowledge and training of our own officers and N.C.O's, and partly with the object of encouraging the Italians "to do likewise." We felt that the Italians had a good deal to learn from us as a result of our experiences on the French front, and undoubtedly they could teach us much about mountain warfare and other conditions peculiar to the Italian front. Therefore they were invited to send officers and N.C.O's to our schools and vice-versa; and there is no doubt that this interchange helped considerably towards a mutual understanding.

In March 1918 things were becoming unpleasantly exciting in France, and it was decided to recall General Plumer and his staff from Italy, and with him the 11th Corps. The 14th Corps under Lord Cavan remained in Italy. This corps consisted of the 7th, 23rd, and 48th Divisions, together with the heavy artillery of the corps, which possessed only one piece larger than the 6-inch howitzer. This was a 9·2-inch howitzer on an experimental travelling field carriage. As far as the writer knows this was the only 9·2 carriage constructed on these lines, so it must be concluded that it did not prove a success, though highly spoken of by the officers who had the handling of it.

The Asiago Plateau.

In April the 14th Corps was transferred to the Asiago Plateau, an underfeature jutting out from the lower slopes of the Alps. Its summit was about 3,500 feet above sea level, approached by very steep roads, with many zig-zags and hairpin bends. It was considered that the British troops would gain useful experience in mountain warfare on this position, which was not the real thing but led up to it gradually. The Asiago ridge was a most important point in the line, to be held at all costs, as the loss of it would have given the enemy command over the fertile Venetian plain. It also constituted an essential connecting link between the low-lying Piave position on the right and the high Alps position on the left. That British troops should be asked to assist in holding this point was a graceful acknowledgement of the high opinion which had been formed of them during their few months sojourn in Italy.

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The Asiago ridge, on which our position was sited, is very rocky, covered with pine forest, and in some places precipitous. It completely dominates the broad grassy valley in which the town of Asiago is situated. The Austrian front line system was in this open valley, while our position was on the forward slope of a pineclad ridge, our front line being on the edge of the valley along the lower line of the forest. Our communications therefore, although on a forward slope, were concealed by the trees; whilst the Austrian's were very exposed and movement could only be undertaken by them at night.

Observation over the enemy lines was exceptionally good, and the panoramic view of the great Alps in the background was superb.

Battery positions were dotted about in the forest, but considerable difficulty was experienced in siting guns. In the first place trees masked the fire and a certain amount of felling was necessary in front of each gun. As little as possible was done owing to the risk of giving the show away, and arcs of fire were consequently rather limited. The 18-pr. positions being on a forward slope flashes were visible, therefore most of the registration and other routine shooting was carried out from "lone gun" positions two or three hundred yards to the flanks of the main positions.

Actual gun platforms were exceedingly difficult to find owing to the rocky and precipitous nature of the ground; consequently the guns of a battery were frequently dotted about without any regard to line or interval, and appeared to have no connection with each other. Rock drills became part of the equipment of batteries, and much use was made of them. On account of this haphazard siting of guns it was necessary to make out elaborate concentration and position correction tables.

The fighting on this portion of the front was limited for the most part to raids on small and large scales. A notable exception was the determined attack by the Austrians on June 15th. This attack was carried out on a wide front from the Asiago along the Piave river to the sea. The Austrians succeeded in crossing the Piave at one or two places, notably at the eastern end of the Montello ridge, and opposite Treviso. Their success was shortlived however, and they were driven back across the river after a few days fierce fighting. The luck was not with the Austrians, as after they had crossed the river it became flooded, and most of their temporary bridges, on which they depended for food and ammunition supply, were swept away. The attack on our position on the Asiago was very determined, but was successfully met; with the result that after a penetration of about 1,000 yards on less than a mile of front, our front line was intact at the end of the first day. On this occasion some gallant deeds were done by batteries in the more forward positions. Guns were run out of their emplacements to engage advancing infantry at point blank range, and in some cases the gunners made effective use of their rifles at close quarters when almost surrounded by the enemy, who had advanced under cover of a thick mist.

This was a great day for our counter-battery groups. The enemy guns were strongly reinforced under cover of darkness during the night previous to the attack; but concealed positions were very limited

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in the open valley below us, and daylight revealed many hostile batteries in action in the open, which were quickly put out of action by our 6-inch howitzers. The Austrian attempt at an unregistered bombardment was not a success. After the preliminary shelling of our front line system the enemy infantry received negligible support from their guns.

After this flare up things remained fairly quiet for some months. News of the success of the operation on the French front in the autumn of this year filled our troops with a desire to strike a blow in Italy, but it was not until October that their patience was rewarded.

The final Piave battle.

The Italian High Command decided to make a crushing attack along the Piave river front on October 23rd. It was felt that the Austrians had not got much heart left for the struggle, and that a really determined attack would probably finish them off. The British corps was invited to take a prominent part in the attack, the 7th and 23rd divisions being moved to the Piave front, while the 48th division remained on the Asiago. The greatest secrecy was observed, the move of our two divisions being deferred till the last moment. The British commanders and staff reconnoitred the Piave position garbed in Italian uniforms, and the troops did not move into position until the night before the atack.

In order that the opening barrage should be accurate without the help of previous registration, it was necessary that the guns should be well calibrated. It had not been possible to carry this out on the Asiago position, where angles of sight were large and maps not too accurate. Therefore a range was selected behind the lines in the vicinity of the Artillery School, and one gun from each 18-pr. and 4·5-inch howitzer battery was sent to the school to be calibrated. Battery commanders knew the relative shooting capabilities of their guns sufficiently well to arrive at their muzzle velocities, provided that of one of their guns was known. The meteor expert with his instruments was present at the firing point during calibration, and a survey officer plotted the range. That the results were satisfactory was proved by the accuracy of the barrage, which contributed very largely to the success of the attack.

The British divisions can undoubtedly claim great credit for this success. Their first objective was an island in the Piave river, which was seized at night, the defenders being completely taken by surprise. From this foothold they attacked the main position on the opposite bank, and here a grim struggle took place, which resulted in a complete success for our arms. The advance continued each day in the shape of a wedge formed by our two divisions. The Italian attack on our right and left had not succeeded at first, and at one period there was some danger of our troops being isolated through lack of support. Further determined attacks by the Italians were more successful and the Austrian retreat soon developed into a rout. The 48th Division was equally successful on the Asiago front, and it soon became obvious that the end was in sight. The armistice with Austria was declared on Nov. 4th., 1918.

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General Notes.

Various interesting points arose in connection with gunnery during our sojourn in Italy.

Large angles of sight. Owing to the mountainous nature of the country over which much of the fighting took place very large angles of sight were experienced, in many cases over five degrees and occasionally as large as ten degrees. This brought home to us the fact that the trajectory is not rigid. In the case of flat trajectory guns the alteration is almost negligible, but in the case of howitzers it was found necessary to make considerable allowance. No table of corrections was available until an article was published in the R.A. Journal of January 1918, and eventually an official table was issued as an addendum to the Range Tables.

50% Zones. When firing against steep mountain sides the 50% length zone on the ground is considerably shorter than on level ground, and when shelling a reverse slope it is considerably larger.

Transporters. The difficulty of moving guns over mountainous country traversed only by narrow precipitous tracks is obvious. The Italians make use of "Transporters," which consist of pairs of low wheels on a short axle on which the gun and carriage can be fitted when split up into two or three parts. To illustrate the idea we will take the case of the Italian field gun. The gun is dismounted and the wheels and shield removed. The carriage is placed on its side with the axle vertical on a transporter. The gun wheels are fitted on a special short axle to which is attached underneath a cradle in which the piece can be slung. The shield rests on another fitting above the axle. The gun and carriage can thus be manhandled on narrow mountain tracks in two portions. Medium guns and howitzers are dealt with on similar lines. Our ordnance workshops converted some Italian transporters to suit our equipments in case the necessity for their use should arise, but they were never required. The ability of the Italians to move their light and even medium artillery to what appeared to be quite inaccessible snow-clad peaks was nothing short of wonderful.

Trench mortars on pack. A certain number of our 6-inch trench mortars were converted for pack transport. This necessitated cutting the piece in half, and connecting the two halves by a junction nut. This was carried out in the local ordnance workshops, and pack saddlery and fittings were improvised by regimental saddlers. Had occasion for their use arisen no doubt the experiment would have been fully justified.

Close country. In very flat enclosed country such as the Venetian plain on both banks of the Piave river the difficulty of observation is very great. In this region the country for many miles is absolutely flat and covered with very small fields bounded by vines 8 to 10 feet high, which are trained on rows of mulberry trees. It is impossible to observe a target at any distance except from the tops of campaniles which would form a conspicuous mark for the enemy's artillery. The problem therefore was no easy one. An observation post within 200 yards of the target necessitates either long telephone communication or guns being brought up to very short range. In moving warfare the latter would seem to be the only solution.

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ANTI-AIRCRAFT?

(Reprinted from the "Journal of the United States Artillery," February. 1921.)

BY MAJOR H. J. KNERR, C.A.C.

AT the present stage of the development of Anti-Aircraft Artillery it may be generally stated that airplanes are brought down, not by gunfire skilfully directed, but as a result of an airplane unskilfully manœuvred.

A pilot as a rule, having already discounted his chances of returning from his mission, is intent upon a successful prosecution of that mission and the puff-balls of black or white interest him not at all so long as they bloom above his path. If they appear below, or close to right or left, he may slip his heels below the rudder bar, feel the throttle full out, and casting an inquiring eye aloft to his protecting flight, drive on, hoping for the best and expecting the worst. He may turn over in his mind the happy thought that one of two things is bound to occur. Either he will be hit or he will not. If he is, it won't last long. If he is not—well, the chances are a million to one that he will not, so why worry! He is reminded that in 1917 some fifty-odd planes were brought down, a one in ten thousand chance. In 1918 it was a one to eight thousand shot with the two hundred some planes downed. And all through error! Never will he admit that a gunner deliberately hit a ship. It is the wild shots that occasionally get in the way and which some one must blunder into to make the sporting chance interesting enough for the gunners below to induce them to devote much time, men and money to his harassment. *Pud*! PUD! PUD!—Jerked upright against the belt by a wallop over the tail that makes the whole ship vibrate like a drum the pilot sees the white-armed puffs eagerly reaching for him ahead. He cuts and stalls, until, his stick a lifeless mushy thing in his hand, he gives her the gun and tail up, jumps ahead again at a 125 mile clip. He sees the bursts draw ahead, stop, and as he turns to grin at his gunner, blossom again far in his wake. Other bursts appear, some ahead, some high and some to one side. They are trying to adjust! But he is no longer interested. His mission demands all of his attention and will suffer by just the amount he might divert to the guns below. Only the first burst of a barrage can catch his attention now. If the jinx of probable error does not get him then the battery only wastes ammunition in his further pursuit, for unconsciously almost, the pilot noses up or down, turns imperceptibly to the side, crosses his controls gently and skids down wind, until, the battery becoming exasperated, looks for other game. Well! From the battery point of view that fellow is gone! It might be well for us to analyze the problem and determine why we failed to get him. There still remain 7779 shots to go before we can expect results. Perhaps we can devise a means of cutting down that ratio.

It has often been stated that an airplane occupies the same status with reference to an Anti-Aircraft battery that a naval vessel

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does to a shore battery. It does—and then some! The introduction of the third dimension has complicated the problem immensely. However, we should be cheerful. It will be time to growl when the fourth dimension introduces itself.

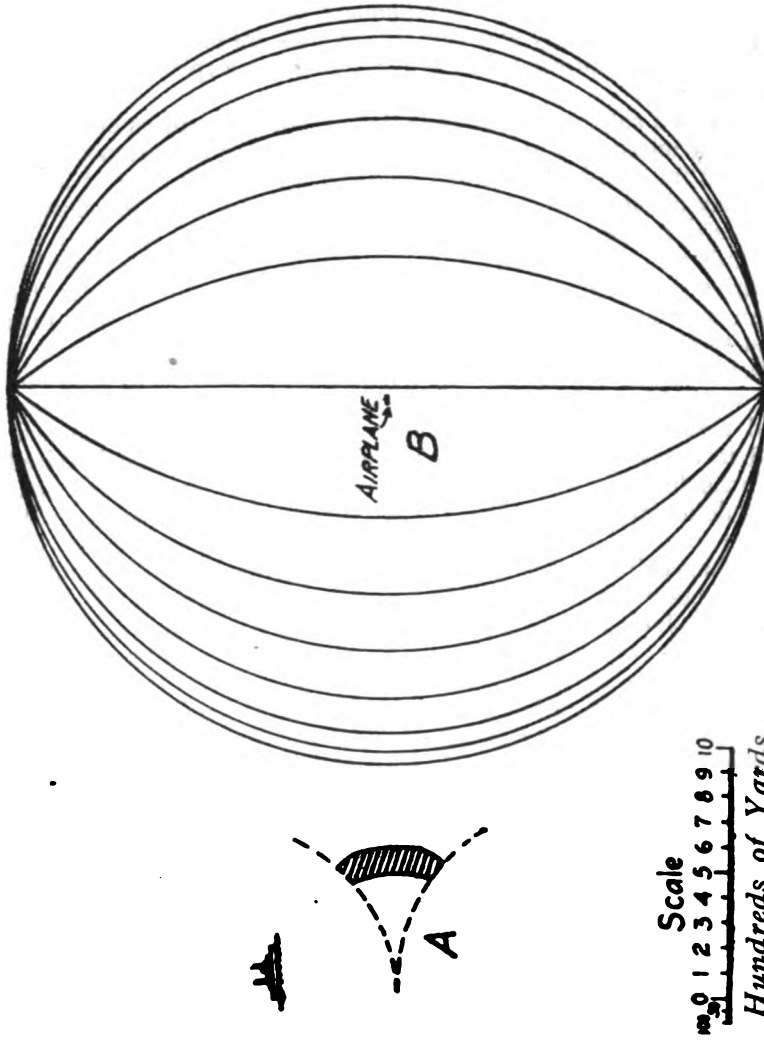

Fig. 1.

Now, in the case of the naval vessel of say, thirty-five knot speed and seven hundred yard turning radius we are confronted with a target limited to a *plane* of action defined by the shaded area of "A" in Fig. 1, whereas in the case of the airplane of 100 miles per hour speed the target is limited to a *sphere* of action three thousand yards in diameter depicted at "B" in Fig. 1. Time, thirty seconds. Both figures are drawn to the same scale and in the assumption of types the comparison

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made as favorable to the battleship as possible. Compare the possibility of hitting an object the size of a battleship in the shaded area of "A" in Fig 1, with that of hitting an object the size of an airplane somewhere within the sphere of "B" in Fig 1. The reason why that airplane got away begins to become evident! We are pecking away at it with inadequate weapons. We are snipe hunting with a rifle—or worse, with a bag and lantern.

In order to be certain of hitting the plane last observed at the center of its sphere of action we must fill that sphere with destruction, either by means of a single burst of sufficient size or by means of a single burst of sufficient size or by means of a sufficient number of smaller bursts properly dispersed. The capacity of the sphere being only fifteen billion cubic yards the first means is obviously impossible. The alternate means, when we consider that it would require at least a million shell properly distributed and simultaneously exploded, is an impracticability. Therefore we are forced to the conclusion that we cannot be certain of hitting the airplane and must develop a system or method that will give us a good chance of placing an obstacle in the path of the pilot when he is not expecting it. Certainly the pilot is going to be on his guard and we will be successful only if we surprise him. Consequently we cannot rely upon observation and adjustment but must develop a technique that will plant a cluster of bursts of sufficient density and extent in his immediate vicinity without giving him a warning of any kind. If this reception does not result in his prompt return to Mother Earth's too fond embrace we had better save our ammunition, for thereafter it become a guessing contest between the battery and the pilot with the odds infinitely in favor of the pilot.

What matériel will such a system demand? Doubtless we have taken a step in the right direction with our present equipment and methods. That it is but a step is too painfully evident. If the Anti-Aircraft Artillery is to justify its continued existence great improvement is demanded not only in the technique of their employment, but in the guns themselves. The net result of the war was to drive the reglage and reconnaissance planes to greater heights from which they descended when necessary regardless of the Archies. Until a suitable method of making a photographic reconnaissance from great heights regardless of light conditions, is developed, planes on such missions are bound to come within reach of the guns. Bombing missions will be pushed through to a successful conclusion regardless of any aerial barrage. The moral effect of Anti-Aircraft fire is its greatest asset and you can always find pilots who will force themselves unhesitatingly through apparently certain destruction. Yet we must force the planes up and keep them up or be ready to combat them on equal terms. Our guns then must be designed to meet the problem and not made over from what may happen to be on hand. It does not seen reasonable to expect a gun designed for attack of planes at great altitudes to function equally well against low-flying, heavily armed and armored harassment planes. In the first case a gun of great power throwing a shell with high explosive energy is required, while in the second instance a light gun of great flexibility and automatic operation delivering a projectile containing a percussion and incendiary element.

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is needed. In either case the guns must be of the maximum caliber consistent with their mission.

The type of plane that will normally present itself as a target should control to a large extent the type of gun opposed to it. It is self-evident that a heavy slow-moving bomber will not fly at twenty thousand feet. Similarly it will be abnormal that the single seater or the two seated fighter will descend to intimate terms with the ground batteries. The heavy armoured ships, mounting 37-mm. cannon and from two to ten machine guns of ·50 caliber will be flying low, looking for troops and Anti-Aircraft batteries. It behoves those batteries to equip themselves with automatic cannon that are able to keep on a swiftly moving target and break through its armour before they are driven to cover or destroyed. It is believed that the 6-pdr. is too small and that the 3-inch can be made free-pointing and automatic in its operation to combat this form of attack. Lacking planes to drive away the high hung targets we must have guns that will speak with sufficient authority to accomplish the same end. Since the angular travel of planes at fifteen and twenty thousand feet is not great, our gun can be of as large caliber as breech operation and ammunition service will permit. It is believed that, with air operated breech mechanism designed for vertical fire only, the 6-inch is not too large. The temptation to see 6-inch bursting where 3-inch and 4·7-inch now are is very great.

Having assumed two calibers that appear to accomplish our purpose, let us test them by the tactics that they will be called upon to combat. The elements of our target's defense will compose:

1. Altitude.
2. Speed.
3. Direction.
4. Armor.
5. Armament.
6. Visibility.

1. The mission upon which a plane is engaged determines to a large extent its type, and, within the limitations imposed by its type, it will seek altitude for the reason that its sphere of action enlarges as the cube of the time of flight required for a shell to reach it. The altitudes at which planes will operate in the next war will demand a 6-inch gun to reach them.

2. Speed, properly controlled, will utterly confound the gunner. The very foundation of his fire control system rests upon the assumption that the target will maintain its course and speed. The average plane is extremely flexible in speed. By skilful manipulation of the throttle and the angle of incidence, air-speed can be varied through a range of 100 m.p.h. within a very few seconds. From the vicinity of the battery the change can not be detected until too late.

3. Direction changes, small and imperceptible, are enough to clear a ship of the effect of a burst that would have occurred in its path. A change of six to ten degrees in effective direction without changing the ship's heading can be made by side-slipping down wind. At the same time a rapid change in altitude is effected and constant altitude is another basic assumption on the part of the gunner. More violent changes can be introduced but as a rule are neither necessary nor desirable. Temperamental pilots, (more *temper* than *mental* by

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the way,) may indulge in acrobatics as a defense or as a means of expressing contempt, but it is of doubtful expediency since the performance results in holding the ship within the shelled area and it may blunder into a wild one.

4. Armor is of no value except against small-arms bullets. It will be found on the ground-harassment planes of the future. These planes will be the targets for our automatic cannon. As already indicated a free pointing arm of 3-inch caliber controlled by tracer ammunition is very desirable.

5. The armament of these harassment planes, as previously mentioned, is sufficiently powerful to demand special measures to counteract it. That anything less than an automatic weapon will suffice is unreasonable.

6. Visibility will vary from 0 to 100 per cent. Clouds and haze will be taken advantage of by the air forces to the fullest possible extent. The attack of planes under these circumstances will have to follow the methods of night defense. Darkness is alike a great protection and a great handicap to the airman. Once away from his airdrome the pilot is dependent upon his instruments. Deprived of the normal means of conducting himself through space the darkness has disturbed his mental and psychological equilibrium, if not his physical. If our fire control, either by means of single stations and the cotangent method of plotting, bilateral listening and plotting or radiometric methods, is able to place a barrage of fair intensity in the path of the pilot we stand a good chance of discouraging him and inducing him to change his course. We have only to force him to change his course a few times and he will miss his objective.

CONCLUSION.

From the foregoing it is apparent that the Anti-Aircraft Artillery to be efficient must be equipped with guns of sufficient power and in sufficient number to be able to place a very great number of bursts at some one point in the heavens at a certain given instant. Further, it must be controlled by a technique able to plant the mean center of burst at that particular point in the heavens at which we predict the target will be at the moment of burst. Also the burst itself must be of sufficient power to destroy a plane in its vicinity. Simple, is it not! We have before us a problem filled with variables and "ifs," compared to which Siacci's is merest childsplay. In fact, it is a problem that is economically insoluble. Consider what it would mean to protect the industrial centers of one coast by an Anti-Aircraft Artillery defense as efficient only as that thrown about the City of Paris in the late war, when the cost alone for a city the size of Washington, D. C., would be in the neighbourhood of twenty-five million dollars. In the face of such costs it would be well for us to stop, look and consider. Is Anti-Aircraft Artillery the proper solution of the problem? Who said Anti-Aircraft Artillery in the first place? Why assume that they were right? Because we used such artillery in the recent war is no argument that we must necessarily continue to use it. As a matter of fact it was an expedient forced upon an inferior Air Power early in the war. It was a natural tendency that a Power weak in Air Forces

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should attempt to offset the disadvantage by Artillery fire. Is the Coast Artillery going to continue to foster the idea merely because the fortunes of peace have thrust it upon us? By emplacing a few fixed batteries in the vicinity of politically important cities and providing a scattering of mobile outfits elsewhere we are a party to lulling the country into a false sense of security. If we feel morally certain that, in spite of every effort that can be put forward in times of peace, we will not be able to provide a single city with an Anti-Aircraft Artillery defense able to keep out so much as 75 per cent of an attacking air force, are we willing to accept the responsibility that will be ours when that defense breaks down completely in time of war? It is submitted that the entire Anti-Aircraft Artillery idea is a snare and a delusion.

At best, an Artillery defense of the great Third Flank is a passive one and such a defense is doomed to failure through its own inherent weaknesses. An active defense, though inferior in strength is often successful because of the fact that it is active. The simplest, easiest, most economical and most efficient method of defense is to employ the same method by which attacked, i.e. Anti-Aircraft Aircraft. It is believed that the peculiar requirements of the problem require the assignment of this defense to the Air Service as a part of their strategical mission. With the great advantages of extreme mobility and operation in their own element, that branch of the Service has immense possibilities for the most efficient solution of the problem; possibilities that the Coast Artillery with its equipment and handicaps cannot hope to approach.

No doubt new types of aircraft and new methods would be necessary. It is conceivable that for night defense the development of dirigible searchlight platforms to be disposed along the threatened frontier attended by dirigible motherships of small fighting craft to be released when the attacking forces were heard and spotted, might be necessary. Even so, an efficient force available at any point with practically no warning necessary, could be provided at a cost, which in comparison with an Artillery program, would be negligible. Further, if such a scheme were logically continued in time of peace in the development of commercial aviation it would be possible to keep alive an industry that could be rapidly expanded to meet the needs of war as well as to keep on hand in actual use equipment that could on very short notice, be converted to the purpose for which originally intended. Carried further, this program would do more to place this country in a position to practically prohibit war. Seapower, once considered so essential, is rapidly losing its importance. Its place is certain to be usurped by Airpower. Is this country again to be left in the position of inferiority that has been its lot in the past? Strangely enough, the question of proper aerial defense is bound up in the same answer.

Let us above all forget false pride and determine upon the most efficient defense possible and bend all energy to its development and prompt disposition, for

"What boots it at one gate to make defense
And at another to let the foe in."

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

Journal of the U.S. Artillery.—May, 1921.

Self Propelled Artillery—Parts II & III. (Prize Essay by Maj. William T. Carpenter. Continued.)

Belgium.

Bulletin belge de Sciences Militaires.—June, 1921.

I. Belgian Strategic Railways during the War. Concluded. Maj. Denis.
II. The effect of the war on Artillery. (A lecture by Gen. Pontus to the Liège Garrison, Feb. 23. 1921.)
III. Gas Warfare. (Continued.) Dr. Sillevaerts.
IV. Notes on Armoured Cars. (Continued). Cap. Comdt. Vander Donckt.
V. The League of Nations.
VI. Notes on Foreign Armies.

France.

Revue Militaire Générale.—April, 1921.

I. The attack on Maubeuge by the Germans. Capt. Koeltz.
II. The evolution of doctrine and regulations before the war, and the technical value of our Infantry. (Continued.) Lt.-Col. P. A. Cour.
III. Events in Upper Silesia.

Revue d'Artillerie.—May, 1921.

I. Marshal Foch's speech on the centenary of the Emperor Napoleon's death.
II. Evolution of new ideas during the war on the use of Artillery. Col. Maitre.

The author commences with pre-war teaching and sums it up by saying that previous to the war it was considered that almost entirely 75's would be used.

On mobilization they had 3,840 75's with 1,300 rounds per gun.

308 mobile heavy guns—104 quick-firing but having short range.

Col. Maitre goes on to point out the lessons of the various stages of the war.

(1) August—Oct. 1914.
(2) Trench warfare period.
(3) Defensive battle of Verdun.
(4) The 1916 Offensive.
(5) The attacks in 1917.
(6) The 1918 Campaign.

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He concludes by summing up the lessons of the war. There has *not* been a revolution in the ideas of the use of Artillery, but rather a progressive evolution of methods of using it based on the battle experiences.

The artillerymen have ceased to be Field or Foot Artillerymen. They have become simply Artillerymen knowing all the characteristics of the arm, and capable of using all natures.

Commanders of all grades have learnt the part the artillery plays in war.

He hopes the artillery will never revert to a 'sealed compartment' again and quotes Regulations made in 1920 to ensure units of the artillery in peace time being under the Generals who will command them in war.

III. The manufacture of shell for the 75.
IV. Fire tactics. Chapter II. Col. E. Cambuzat.
V. Pocket cipher message sending and reading card. Lt. Cabassol.
VI. Note on curvilinear recoil. (Continued). Capt. Olive.

Switzerland.

Revue Militaire Suisse.—May, 1921.

I. The evolution of Offensive Actions. (Continued). Lt.-Col. H. Corda.
II. Tactical schemes worked out for the use of Infantry Units. Maj. Schmidt.

REGIMENTAL LIST. The following Postings have occurred during the period 16th May, to 15th June, 1921.

Postings.—R.H. and R.F.A.

Aldridge, Lieut. A. W., from Att. Irish Comd., to 1st Bde. R.F.A., Kilkenny. 24/3/21.
Bareham, Lieut. F., from 5th Bty. R.F.A., Aldershot, to H.Q., 37th Bde. R.F.A. 31/5/21.
Barraclough, Lieut. A. J., D.C.M., from Staff, War Office, to IV. Res. Bde. 1/6/21.
Bastyan, Lt.-Col. (Rid.-Mr.) S. J., from India, to III. Res. Bde., R.F.A. 24/5/21.
Block, Major A., D.S.O., from Adjt. T.F., to 9th Bde. R.F.A., Deepcut. 21/5/21.
Bonham, Lieut. J. E., from 141st Bty., to IV. Res. Bde. 18/6/21.
Bower, Lieut. St. C., from H.Q., 37th Bde. R.F.A., to 3rd Bty., R.F.A. 31/5/21.
Curling, Major J., O.B.E., from 108th Bty., to H.Q., 23rd Bde. 3/6/21.
Cottrell, Major (Bt. Lt.-Col.) R. F., D.S.O., from Unposted, to 108th Bty. 3/6/21.
Drake-Brockman, 2nd Lt. R. F. H., from 19th Bty. R.F.A., Deepcut, to 76th Bty. R.F.A. 24/5/21.
Drew, Lieut. A., from "M" Bty. R.H.A., to "M" Bty. Ammn. Col. 29/4/21.
Eddis, Major L. A., from IV. Res. Bde., R.F.A., to Adjt., IV. Res. Bde., R.F.A. 17/5/21.
Ettlinger, Lieut. E. S., M.C., from 37th Bde., to R.E. Mounted Depôt. 1/6/21.
Ford, Lieut. (D.O.) W. T., from 2nd D.A.C., to 1st D.A.C. 1/6/21.
Gough, Lieut. W. F. H., from 86th Bty., to 2nd D.A.C. 1/6/21.
Goschen, Lt.-Col. A. A., D.S.O., from Staff, to Attd. 5th Bde., R.H.A. 24/5/21.
Granet, Major G. E. A., D.S.O., M.C., from Adjt. T.F., to 31st Bde., R.F.A. 23/5/21.
Hammond, Lieut. H. B., from R.A.F., to 17th Bde. R.F.A., Mesopotamia. 17/5/21.

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Postings R.H. & R.F.A.—*Continued.*

Hamilton, Major G. T., D.S.O., from 14th Bty. R.F.A., to 4th Bty., R.F.A. 21/5/21.
Johnstone, Capt. G. H., D.S.O., from 144th Bty. R.F.A., to Adjt., City of London R.H.A. 26/5/21.
Joyce, Lieut. W. T. C., from VI. Res Bde., to Attd. R.E., Ireland. 14/6/21.
Kay, Lieut. H. G. A., from Tank Corps, to 53rd Bty. R.F.A., Fermoy. 21/5/21.
Kirkman, Lieut. S. C., M.C., from "B" Bty. Ammn. Col., R.H.A., to "B" Bty., R.H.A. 29/4/21.
Leggatt, 2nd Lieut. W. M., from 1st Bty. R.F.A., to 5th Bty. R.F.A. 31/5/21.
Le Maistre, Lieut. G. A., from Staff, War Office, to IV. Res. Bde. 1/6/21.
McMaster, Major W., M.C., from IV. Res. Bde. R.F.A., to Adjt., 5th (Pembroke & Cardigan) Army Bde., R.F.A. T.F. 21/5/21.
Melville, Lieut. W. R. O., from Tank Corps, to Attd. 16th Bde. R.F.A. 25/5/21.
Mason, Lieut. B. G., from "B" Bty. R.H.A., to "B" Bty., Ammn. Col. 29/4/21.
Popham, Major G. L., D.S.O., from Adjt., 5th (Pembroke & Cardigan) Bde., R.F.A., T.F., to India. 25/5/21.
Preeston, Lt.-Col. N. P. R., D.S.O., from 3rd D.A.C., to H.Q., 26th Bde. 14/6/21.
Pyke, Lieut. M. A., from IV. Res. Bde., to 120th Bty. 4/6/21.
Reeves, Major R. C., D.S.O., from 4th Bty. R.F.A., to 14th Bty. R.F.A. 21/5/21.
Rogers, Lieut. W H. G, from 139th Bty., to R.E. Mounted Depôt. 6/6/21.
Russell, Lieut. H. E., from "M" Bty. Ammn. Col. R.H.A., to "M" Bty. R.H.A. 29/4/21.
Schreiber, Capt. (Bt. Maj.) E. C. A., D.S.O., from Staff, India, to Adjt., 24th Bde. 14/1/21.
Taylor, Lieut. A. St. L., from Unposted, to 33rd Bty. R.F.A. 28/5/21.
Taylor, Lieut. A. St. L., from 33rd Bty., to IV. Res. Bde. 3/6/21.
Thursfield, Lieut. R. M., from R.E. Mounted Depôt, to 138th Bty. 6/6/21.
Wallis, Capt. K. H., from I. Res. Bde., R.F.A., to Adjt., 52nd (E. Lancs) Bde., R.F.A., T.F. 23/5/21.
Whatton, Capt. S. M. de H., D.S.O., M.C., from 110th Bty. R.F.A., India, to Adjt., 21st Bde., R.F.A., India. 25/3/21.
Wheatcroft, Lieut. J., from R.E. Mounted Depôt, to 5th Bty. 6/6/21.
Wilson, Major D. C., D.S.O., from Staff, to Unposted. 23/3/21.

Cancellation of Postings.

Bastyan, Lt.-Col. (Rid.-Mr.) S. J., to Colchester.
Mitchell, Lieut. A. J., to 53rd Bty. R.F.A., Fermoy.

Staff Appointments.

Black, Lieut. C. McC., from H.Q., Irish Command, to Attd. Tank Corps. 8/6/21.
Bruges, Lieut. W. E., from 20th Bde. R.F.A., Bangalore, to Adjt., Madras R.G.A. 12/1/21.
Campbell, Lieut. A. P., from Staff, India, to be Temp. Capt. 5/4/21.
Chandler, Lieut. E. L., from Staff, Resigned Commn. 3/6/21.
Custance, Major S. N., from 16th Bde., to "Q" Branch, G.H.Q., E.E.F. 17/5/21.
de Robeck, Lieut. B. L., from A.-D.-C., to 39th Bty. R.F.A., Mespot. 26/2/21.
Harrison, Major (Bt. Lt.-Col.) J. M. R., D.S.O., from Staff College, Quetta, to Temp. Lt.-Col. 9/3/20.
Henvey, Col. R., C.M.G., D.S.O., from Half-pay List, to A.A. & Q.M.G., 3rd (Lahore) Divn., Egypt. 2/6/21.
Jones, Lieut. H. C. F., M.B.E., from 12th Bde., to Attd. Officer, A.G. 3, War Office. 8/6/21.
O'Brien, Maj. L. B., O.B.E., from Unposted to Interpreter, Rhine Army. 20/5/21.
Somerset, Capt. R. G., M.C., from 44th Bde., to Staff Capt., 52nd Infantry Bde., Mespot. 26/2/21.
Stewart, Lieut. J., M.C., from 16th Bde., to Camp Comdt., Egypt. 13/6/21.
Thackeray, Lt.-Col. C. B., D.S.O., from Half-pay List, to Inter Allied Comm. of Control, Westphalia. 22/5/21.
Walshe, Col. F. W. H., C.M.G., D.S.O., A.-D.-C., from Half-pay List, to G.S.O., 1st Grade, Mespot. 20/5/21.

Postings.—Royal Garrison Artillery.

Bannister, Lieut. D. W., from 5th Pack Arty. Bde., to 15th Pack Arty. Bde. 6/6/21.
Bennett, Major F. L., from H.Q., Irish Command, to H.Q. & D.E., South Irish Coast Defences. 1/6/21.
Biggs-Davison, Major J. N., from Aden, to R.A. Survey Coy., Larkhill. 26/5/21.

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R.G.A. Postings.—*Continued.*

Bill, Major J. G., from 6th Bty., to Adjt., Orkney R.G.A. T.F. 7/6/21.
Boxwell, Capt. H., M.C., from 21st Bty. Pack Arty., to Pack Arty. Depôt. 1/6/21.
Brannan, Lieut. W., from 12/13 Fire Comd., to H.Q. & D.E. R.G.A., Sheerness. 21/5/21.
Brewster, Major (D.O.) R. E. B., from 12/13 Fire Comd., to H.Q. & D.E. R.G.A., Sheerness. 21/5/21.
Brittan, Capt. C. H., M.C., from 2nd Med. Bde., to 79th Coy. 1/6/21.
Bruford, 2nd Lieut. F. L., from 30th Bty. R.G.A., to 5th Bty. R.G.A. 20/5/21.
Burges, Capt. W., M.C., from 12/13 Fire Comd. to H.Q. & D.E. R.G.A., Sheerness. 21/5/21.
Climo, Lt.-Col. P. H., from 9th Indian Pack Arty., to H.Q. & D.E. R.G.A., Plymouth. 20/5/21.
Courtney, Major F. H., from 39th Bty., to 6th Bty. 1/6/21.
Crouch, Lieut. J. A., from 13 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.
Crozier, Lt.-Col. C. D., from South Irish Coast Defences, to Aden. 24/5/21.
Day, Lieut. H., from "D" Coast Bty., to 2nd Res. Bde. 13/6/21.
Doyle, Capt. (Qr.-Mr.) J. C., from Personnel Arty College, to H.Q. & D.E., Plymouth. 10/6/21.
Drought, Major T. A. W., from Irish Comd., to "A" Coast Bty., Edinburgh. 24/5/21.
Dutton, Major R. M. L., O.B.E., M.C., from 35th Pack Bty., to Unposted. 1/6/21.
Earnshaw, Lieut. C. A., from 21st Pack Bty., to Pack Arty. Depôt. 1/6/21.
Evans, Major C. L., from Half-pay List, to "B" Coast Bty., Edinburgh. 24/5/21.
Farthing, Lieut. H. H., from 13 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.
Finucane, Lieut. (D.O.) F. C., from 3rd D.A.C., to Pack Arty. Depôt. 1/6/21.
Forbes, Major J. L., D.S.O., M.C., from Peterhead Bty. T.F., to Comd., 1st (Highland) Med. Bde., T.F. 3/5/21.
French, Lieut. E. E., M.C., from 15th Pack Bty., to 29th Pack Bty. 6/6/21.
Gee, Lieut. E. E., D.S.O., M.C., Capt. Instr. in Gunnery. 17/10/20.
Goodwin, Lieut. E. A., from 30th Bty. R.G.A., to 5th Bty. R.G.A. 20/5/21.
Hall, Major B. A. M., O.B.E., from 30th Bty. R.G.A., to 5th Bty. R.G.A. 20/5/21.
Hardcastle, Lt.-Col. E. L., D.S.O., from Bulgarian Commn., to H.Q. & D.E., North Scottish. 15/6/21.
Hardy, Lieut. H. A., from Frontier Garr. Arty., to 27th Pack Arty. Bty. 1/6/21.
Hartree, Capt. A., M.C., from 30th Bty. R.G.A., to 5th Bty. R.G.A. 20/5/21.
Hayes-Sadler, Major J., from 38th Pack Bty., to H.Q., 9th Pack Arty. Bde. 1/6/21.
Heath, Major C. J., from Irish Comd., to Adjt., R.G.A., Sheerness. 21/5/21.
Hebert, Major A., from 12/13 Fire Comd., to H.Q. & D.E. R.G.A., Thames and Medway Defences. 21/5/21.
Inglis, Major C. E., D.S.O., from 9th Bde. R.G.A., to Irish Comd. 24/5/21.
Jones, Capt. A. E., M.C., from "J" Coast Bty., Plymouth, to Adjt., 3 Depôt, R.G.A. 24/5/21.
Keene, Capt. G. G., D.S.O., from Staff, War Office, to Adjt., Lancs. & Cheshire T.F. 16/6/21.
Lamb, Major B., from 8th Bde. R.G.A., to 15th Bty. R.G.A. 19/5/21.
MacLean, Capt. F. D., from 12 Fire Comd., to H.Q., Irish Comd. 1/6/21.
Marindin, Major (Bt. Lt.-Col.) C. C., C.B.E., D.S.O., from Unposted, to 13th Bty. 10/6/21.
Moore, Lt.-Col. W. H., D.S.O., from 12/13 Fire Comd., to H.Q. & D.E. R.G.A., Thames and Medway Defences. 21/5/21.
Nicholson, Major St. J. R., D.S.O., from R.A. Survey Coy., to Attd. Coast Arty. School. 1/6/21.
Owen, 2nd Lieut. D. A., from 30th Bty. R.G.A., to 5th Bty. R.G.A. 20/5/21.
Pellew, Major V. H. L., M.C., from Personnel Arty. Col., to H.Q. & D.E., Plymouth. 10/6/21.
Penny, Lieut. M. G., from Aden, to 2nd Pack Arty. Bde. 10/6/21.
Peters, Lieut. J., D.C.M., from Half-pay, to 2 Res. Bde. R.G.A. 26/5/21.
Poland, Lieut. R. H., from Pack Arty. Depôt, to 21st Pack Bty. 1/6/21.
Ryan, Capt. C. J., from II. Res. Bde., R.G.A., to Gibraltar. 16/5/21.
Ramsey, Major (Bt. Lt.-Col.) H. A., D.S.O., from 13 Fire Comd., to "I" Coast Bty., Plymouth. 21/5/21.
Rycroft, Lieut. (D.O.) A., M.B.E., from 12/13 Fire Comd., to H.Q. & D.E. R.G.A., Thames and Medway. 21/5/21.
Somerville, Lieut. R. A. E., M.C., M.M., from 12 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.
Spedding, Lieut. J. E., from 35th Bty. to 34th Bty. 4/6/21.
Tawney, Capt. A. E., M.C., from Pack Arty. Depôt, to 21st Pack Bty. 1/6/21.
Thom, Major J. H., D.S.O., from Attd. IV. Res. Bde. R.F.A., to 13th Bty., R.G.A., 19/5/21.
Thomas, Major A. G., from H.Q., Irish Comd., to "M" Coast Bty., Dover. 21/5/21.

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R.G.A. Postings.—*Continued.*

Thomas, Lieut. G., from South Irish Coast Defences, to H.Q., Irish Command. 24/5/21.
Towers, Capt. L. C., from H.Q., Irish Comd., to H.Q. & D.E., S. Irish Coast Defences. 1/6/21.
Trenchard, Major G. B. B., from Mesopotamia, to "L" Coast Bty., R.G.A., Dover. 21/5/21.
Underwood, Lieut. (D.O.) H., from 3rd D.A.C., to R.G.A., Ceylon. 1/6/21.
Warner, Capt. H. H. M., from 13 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.
Whitting, Major E. le G., D.S.O., M.C., from 11th Pack Arty. Bde., to 35th Pack Bty. 1/6/21.
Whyte, Major T. A., from Adjt., 12 Fire Comd., to H.Q., Irish Comd. 21/5/21.
Willis, Major F. W., from 12 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.
Wood, Capt. R., from 12 Fire Comd., to "M" Coast Bty., Dover. 21/5/21.

Cancellation of Postings.

Alexander, Major W. D., to Aden.
Thom, Major J. H., D.S.O., posting to 13th Bty., cancelled. 10/6/21.
Inglis, Major C. E., D.S.O., posting from 9th Bde., to G.H.Q., Ireland, cancelled. 24/5/21.

Staff Appointments.

Allan, Lieut. A. J. W., from 1st Res. Bde., to Cipher Officer, Silesia. 30/5/21.
Allen, Major (Bt. Lt.-Col.) A. H., C.B.E., from Inter Allied Commn., to Attd. R.A.O.C. 21/5/21.
Bensley, Capt. C. J. F., from Staff, to Unposted List. 24/3/21.
Blyton, Lieut. A. W., M.M., from 7th Bde., to Quartering Committee, 6th Divn. 23/11/20.
Carwithen, Major S., D.S.O., from 22nd Pack Bty., to D.A.Q.M.G., E. Comd., India. 26/5/21.
Coombes, Capt. H. P., from 73rd Coy., to South Persian Rifles.
Eastwick-Field, Capt. W. L., M.C., from I. Res. Bde. R.G.A., to Chief Cipher Officer, Egypt. 28/3/21.
Hallifax, Capt. F. B., from Staff Capt., to G.S.O. 3, Mespot. 12/4/21.
Hire, Capt. D. A. H., M.C., from 4th Bde., to Attd. Officer, A.G. 3, War Office. 2/6/21.
Martel, Brig.-Genl. C. P., C.B., C.S.O.F., Knighthood Conferred. 4/6/21.
Merrett, Capt. A. B., from Attd. Irish Comd., to Staff Capt., Londonderry Area. 14/3/21.
Miller, Lieut. E. C., 11th Pack Arty. Bde., Awarded O.B.E. 1/8/20.
O'Connor, Lieut. H. A., from Staff, India, to Temp. Capt. 1/5/20.
Payne, Major D. W., D.S.O., M.C., from India Pack Arty., to D.A.Q.M.G., 19th Bde., India. 20/4/21.
Pegrum, Lieut. L. V., from H.Q., Irish Comd., to W.A.F. Force. 25/5/21.
Peters, Lieut. W., M.C., from Staff, to Retired with Gratuity. 26/5/21.
Rooke, Lieut. S. T., from 4th Pack Arty. Bde., to A.-D.-C., G.O.C., 17th Divn., Mespot. 3/5/21.
Rothwell, Major R. S., D.S.O., from H.Q., Irish Comd., to Garr. Adjt., Cork. 9/6/21.
Scovil, Major F. H., from Sierra Leone Coy., to D.A.A. & Q.M.G., Sierra Leone. 4/4/20.
Skinner, Capt. R. O., from Coast Defence, India, to Indian Ord. Dept. 25/4/20.
Stephenson, Lieut. W. T., from Attd. Irish Comd., to Attd. Tank Corps. 6/6/21.
Sunderland, Major B. G. E., O.B.E., to be Bt. Lt.-Col. 1/1/21.
Underwood, Lieut. E. E., from 94th Coy., India, to Adjt., R.G.A., Indian Aux. Forces. 6/11/20.
Warton, Capt. (D.O.) H. C., from Attd. Ord. College, to Attd. War Office. 4/5/21.
Withers, Capt. R. B., D.S.O., from Unposted, to 2nd Asst. Supt., Design. 28/5/21.

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REGIMENTAL LIST. The following Casualties have taken place from 16th May, to 15th June, 1921.

Promotions.

Campbell, Lieut. A. P., to be temporary Captain, 5th April, 1920.
Carr, Major H. G., D.S.O., to be Lt.-Col., 21st May, 1921.
Clayton, Major E., O.B.E., to be Bt. Lt.-Col., 1st Jan., 1921
Curling, Major J., O.B.E., to be Lt.-Col., 11th June, 1921.
Duthie, Major A. M., D.S.O., O.B.E., to be Lt.-Col., 11th June, 1921.
Gay, Capt. (Bt. Major) C. H., D.S.O., to be Bt. Lt.-Col., 1st Jan., 1921.
Lee, Lieut. D. H., to be Capt. (with seniority 3/11/17), 12th May, 1921.
O'Connor, Lieut. H. A., to be temporary Capt., 1st May, 1920.
Sanders, Major W. O. S., to be Lt.-Col., 1st May, 1921.
Sunderland, Major B. G. E., to be Bt. Lt.-Col. 1st Jan., 1921.

To Half Pay.

Dunstone, Lieut. W. P., M.C., 25th May. 1921.
Hudson, Lt.-Col. A. R., C.M.G., D.S.O., 1st June, 1921.
Livingstone-Learmonth, Lt.-Col. (Bt. Col.) J. E. C., C.M.G., D.S.O., 31st May, 1921.
Maples, Capt. J. C., temporary, on account of ill-health, 21st June, 1921.
Rickards, Lt.-Col. F. M., to half-pay list, but retains present employment, 9th June, 1921.
Tuite-Dalton, Capt. G., temporary, on account of ill-health, 2nd June, 1921.
Turner, Lieut. A. W., 6th June, 1921.
Webb, Lt.-Col. A. H., C.M.G., D.S.O., 9th June, 1921.
Wyatt, Lieut. A. E., 15th June, 1921.
Wynne, Lt.-Col. H. E. S., C.M.G., D.S.O., 11th June, 1921.

Retirements on Retired Pay.

Alexander, Lt.-Col. W. D., D.S.O., 1st June, 1921.
Barton, Lt.-Col. P., D.S.O., from half-pay, 22nd June, 1921.
Beard, Lieut. J. W., with rank of Capt., 4th June, 1921.
Broad, Lieut. F., M.B.E., from half-pay, 14th June, 1921.
Burnie, Lieut. F. T., from half-pay, on account of ill-health, 21st April, 1921.
Clarke, Lieut. A. V., from half-pay, 24th May, 1921.
Cook, Lieut. D., 25th May, 1921.
Cooper, Lieut. W., from half-pay, 20th May, 1921.
Corrie, Lt.-Col. W. F. T., D.S.O., from half-pay, 9th June, 1921.
De Berry, Col. P. P. E., C.M.G., from half-pay, with Hon. rank of Brig.-Genl., 8th June, 1921.
Dennis, Lieut. T., from half-pay, with rank of Capt., 7th June, 1921.
Downer, Lieut. G. W. F. H., 19th June, 1921.
Fielder, Capt. C. W., 17th June, 1921.
Greaves, Major H. M., 8th June, 1921.
Goodman, Lieut. W. J., from half-pay, 14th June, 1921.
Hicks, Lieut. W. E., D.S.O., M.C., from half-pay, with rank of Major, 4th June, 1921.
Kelly, Lieut. A., from half-pay, with rank of Major, 21st May, 1921.
Kemble, Major H. M., D.S.O., 10th June, 1921.
Killeen, Lieut. C. B., 2nd June, 1921.
Lambert, Col. E. P., C.B., C.M.G., with Hon. rank of Brig.-Genl., 1st June, 1921.
Laxton, Lieut. W. P., from half-pay, 26th May, 1921.
McCracken, Capt. J. L., 26th May, 1921.
McGhee Lt.-Col. A. S. P., 7th June, 1921.
Ritchie, Lieut. W., 11th June, 1921.
Stanley, Lt.-Col. Hon. G. F., C.M.G., 2nd April, 1921.
Symes-Thompson, Major A. H., D.S.O., 3rd June, 1921.
Vise, Lieut. T. A., M.C., 24th May, 1921.
Wilkes, Lieut. A. L., 14th June, 1921.
Youngs, Lieut. C. S., 21st May, 1921.

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Retirements with a Gratuity.

Duplock, Lieut. F., 21st June, 1921.
Peters, Lieut. W., M.C., 26th May, 1921.
Starkey, Lieut. E., from half-pay, with rank of Capt., 16th June, 1921.
Webb, Lieut. W. H., from half-pay, with rank of Capt., 21st May, 1921.

Resignations.

Attwood, Lieut. J. H., 17th June, 1921.
Chandler, Lieut. E. L., 3rd June, 1921.
Dowding, Major (Bt. Lt.-Col.) H. C. T., C.M.G., on appointment to R.A.F., 1st August, 1919.
Gordon-Duff, 2nd Lieut. D. C., 4th June, 1921.
Lumsden, Lieut. E., 13th June, 1921.
Radford, Lieut. L., 17th June, 1921.

Awards.

Bastyan, Lt.-Col. (R.M.) S. J., awarded O.B.E., 1st Aug., 1920.
De Burgh, Capt. H. G., M.C., awarded O.B.E., 16th April, 1921.
Farfan, Major (Bt. Lt.-Col.) A. J. T., D.S.O., awarded O.B.E., 1st Aug., 1920.
Finnis, Major (Bt. Lt.-Col.) F. A., awarded O.B.E., 1st Aug., 1920.
Fooks, Capt. H. E., awarded O.B.E., 1st Aug., 1920.
Grundy, Lieut. J. E., M.C., awarded M.B.E., 1st June, 1921.
Hebbert, Capt. G. K. P., awarded M.C., 14th Oct., 1920.
Lyon, Col. F., C.M.G., D.S.O., awarded C.B., 4th June, 1921.
Martel, Brig.-Genl. C. P., C.B., awarded Knighthood, 4th June, 1921.
Miller, Lieut. E. C., awarded O.B.E., 1st Aug., 1920.
Stewart, Col. C. G., C.M.G., D.S.O., awarded C.B., 4th June, 1921.

Deaths.

Bettridge, Lieut. R. F., 1st Brigade R.F.A., killed, 19th June, 1921.
Donahoe, Capt. (Qr.-Mr.) P., 1st Brigade, R.F.A., died, 26th May, 1921.
Glossop, Lieut. W. G. C., 1st Brigade R.F.A., killed, 19th June, 1921.

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BY MAJOR A. K. HAY, D.S.O., O.B.E., R.F.A.

"It's the song of an artilleryman, moping mum,
"Whose soul was sad, whose glance was glum,
"Who smoked no fag, and who craved no rum,
"As he sighed for the love of a hairy."

(Bab Ballad—adapted).

IT is not possible successfully to champion the cause of a change in warfare, until a clear conception has been formed of the reasons which make that change necessary.

The present proposal can scarcely be due to any failure of the gallant old horse to give of his best, and more than his best in war.

A correspondent of *The Times*, writing of farm tractor trials, says: "Scarcely a vestige of the early prejudice against mechanical power survives, although the horsemen have still no affection for the tractor, and are frankly anxious about the position of the horse."

It seems that gunner and farmer see eye to eye in this matter; for though there is no love of the machine, the Regiment also is anxious about the future of the horse.

In every sphere of transport the horse is being ousted by the machine, and as this continues, the inexorable law of supply and demand will inevitably, if gradually, exterminate the draught horse.

As the supply of horses diminishes, so the various accessories of horse management will decrease. Farmers may be expected to grow less oats and hay. Veterinary officers, farriers and saddlers will seek fresh fields of employment.

For the mobilization of a national army it is essential to utilize the natural and industrial resources of the country.

It may be that in the near future petrol, oil, and factories for the bulk output of machinery will be more plentiful than horses and forage, and that trained mechanics will be more numerous than horsemen.

Preparation for war is a matter of past experience combined with study and foresight; it is for the artilleryman of to-day, with his great experience of war, not only to adapt the future resources of the country to his needs, but to take full advantage of the most scientific means of transport, so that in the replacement of the horse the greatest military advantage may accrue.

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ARRANGEMENT OF THE PAPER.

The first two parts of the paper deal with Horse and Field Artillery, the third part being devoted to Medium Artillery, in this manner :—

Part I.

Object.

To place before technical designers the practical requirements which an artilleryman's experience suggest for consideration.

Arrangement.

The principal systems of mechanical transport will be examined, in order to determine which is best suited to the needs of horse and field artillery. With this system as a basis for discussion, the machine will be followed through the different phases of its life in the field.

In each stage of the "rake's progress", those requirements will be noted which the practical needs of the case demand.

Part II.

Object.

To interest artillery officers in the characteristics, possibilities and advantages of this method of draught.

Arrangement.

The probable influences of the change will be discussed in their bearings upon strategy and tactics.

Part III.

Object.

To direct the attention of those responsible for design and experiment to the system of transport most suited to the needs of medium artillery.

Arrangement.

The system will be deduced from a brief survey of the tactical requirements of medium batteries.

PART I.

Preliminary Considerations.

The comparative economy of mechanical and horse draught in relation to cost and man-power must remain a matter for conjecture until details of the machine and organization have been worked out. Nevertheless, there is one aspect of the economic question which it is necessary to consider as an essential preliminary to the discussion.

The field artillery is now in course of re-armament with a costly 18-pdr. equipment.

Heavy additional expenditure will be incurred by the provision of machines to replace horse draught. The subject of this paper deals with the near future, and within that indefinite period it is reasonable to assume three things :

(i). That we are unlikely to engage in another great European war.

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(ii). That there will be little if any increase in the present annual vote, upon which the Regular and Territorial armies eke out a penurious partnership.

(iii). From (i) and (ii), that we cannot afford to scrap our present equipments on account of a change in the method of draught, and that the replacement of horses by machinery will necessarily be a gradual process, during which there will be opportunity for improvement in design.

It follows that the immediate problem before the designer is the replacement of horse draught for the *existing* field artillery equipments.

SYSTEMS OF MECHANICAL TRANSPORT.

Towing.

This system is in use for 6″ howitzers and heavier natures. In its more practical form a cross-country tractor of caterpillar type is substituted for horses, the gun being hitched to its tail. The obvious advantage is economy, since it can be applied to the present equipments. When the system is extended, however, to the faster moving natures of artillery, serious difficulties arise.

At the commencement of the war, trials were carried out by Territorial artillery to ascertain the practicability of rushing 15-pdr. guns to threatened points on the coast, by towing them behind cars or lorries. The experiment was not of long duration, nor was the 15-pdr. equipment so intricate as that of modern guns, and for these reasons probably, no serious defects were reported.

Subsequent experience in France furnished abundant proof that modern equipments will not stand continued travel at high speeds over long road distances.

Even more serious is the cross-country aspect of this system.

It is common knowledge that wheeled equipments cannot travel in and out of 6″ shell craters. That the tractor should be able to cross such obstacles is of small avail, if the gun be overturned and damaged at the first shell hole or trench.

It may be suggested that the gun should be mounted upon a second caterpillar truck.

In these circumstances, control of the truck would be difficult at high speeds, and there would be violent jerks and other difficulties when crossing obstacles, whilst the truck would be merely a further impediment on coming into action.

In any form then, the principle of towing is unsuited to the rapid movement of horse and field artillery equipments, on the road or across country.

Carrying.

During the third battle of Ypres, a large tank was exhibited, which was capable of carrying a 60-pdr. or 6″ howitzer in its interior.

There was no intention or arrangement to fire the gun from the tank, the latter being used exactly as a lorry is used to carry baggage. The gun was run into the tank on inclined skids, being drawn in by a wire hawser wound from the engine.

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The system permits the use of present equipments, and further, it has none of the disadvantages peculiar to towing.

There can be no doubt that this type of machine would prove an efficient carrier of field guns, but it does not satisfy tactical requirements. Having gone so far it will be wiser to go one small step further, and reap the full tactical benefits of mechanical transport.

Propelling.

There is the same tactical distinction between this system and the last as there is between the battle cruiser and a naval transport carrying a cargo of field guns.

The one is a fighting machine, the other a transport pure and simple.

There may be two variations of the system:

(i). Where the gun is mounted on a central pivot mounting. In this case the gun is definitely attached to, and can only be fired from the chassis, in the same way that an anti-aircraft gun is mounted on a lorry.

From a tactical point of view it is essential that the gun should be capable of use on the ground when required, independently of the tank carrier.

This is not possible, nor can the existing equipment be used.

Whatever advantages may be claimed for the pivot mounting, it should be ruled out on the score of these two disadvantages alone.

(ii). In the second variation, the gun is mounted on its ordinary field carriage, which in turn is mounted upon a mechanically propelled chassis in such a way that the gun may be traversed and fired on the chassis, or be rapidly dismounted and fired from its carriage on the ground.

It is upon this system that designers should concentrate their energies, and it is the progress of this machine in the field which will be examined, in the hope that some practical suggestions may be found to assist the experts in their task.

SERVICE CONDITIONS WHICH AFFECT DESIGN.

Entrainment.

Two types of bogey trucks are available for the conveyance of tanks. The dimensions of the vehicle they carry are:—

Weight: 35 and 40 tons.
Length: 34 and 40 feet.
Width: 8 feet 3 inches and 8 feet 5½ inches.
Height: 9 feet 2 inches.

It may be necessary to hold these figures in mind when the medium artillery problem is approached, but for field artillery other considerations will exercise more stringent limitations than those imposed by the railway.

Shipment.

One side issue of this operation is so important that it cannot be allowed to pass unnoticed. At home ports, the cranes on the quays

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will be of sufficient power to cope with heavy machines, but this may not be the case at the port of disembarkation. If a landing has to be made on an open beach, then assuredly the ship's derricks and winches will have to handle the machines.

It is understood that a number of merchant vessels, hitherto earmarked as Admiralty transports, would be unable to cope with such a situation, through want of powerful derricks and other facilities.

Clearly these considerations cannot be allowed to hamper design, but it is important that the attention of the Naval Transport authorities be called to the steadily increasing weight and bulk of military equipment generally.

The Line of March.

The various points will be taken in turn :—

(a) *The Sub-section.* The three vehicles composing a sub-section of horse drawn field artillery occupy 60 precious yards of road space.

It will make for clearness if the 18-pdr. is selected as an illustration.

For tactical purposes the sub-section is divided into two parts, the "firing battery" and the "first line." The allotment of men and ammunition to the two echelons is: firing battery, 7 men and 100 rounds; first line wagon, 3 men and 76 rounds. The quantity of ammunition carried in the sub-section is the measure of eighteen horse power, and not of tactical requirements. With mechanical transport it should be possible to decrease the road space and at the same time increase the ammunition: both important advantages.

A single tank, carrying the gun, carriage, 6 men and 100 rounds of ammunition would replace the two firing battery vehicles.

Another tank, carrying the coverer and 3 ammunition numbers, together with 200 rounds, would take the place of the first line wagon.

In each case a driver and a mechanic would be added, both of whom should be R.A., and not R.A.S.C. or Tank Corps. The detachment would thus remain at 10, whilst the drivers would be reduced from 9 to 4.

Allowing each tank a length of 9 yards and 6 yards distance, the road space of the sub-section would be reduced from 60 yards to 30. The ammunition would be increased from 176 rounds to 300.

In horse artillery, the saving in men and road space would be greater, since the detachments would be carried in the tanks without horseholders.

It is possible that 3 more ammunition tanks would have to be added to the total of a howitzer battery, and also that 3 very light tanks might be required by every battery, two for battery staff and one for wagon line staff.

(b) *Speed and Radius of action.* All natures of artillery, in their slower paces, will require to conform to the march of an infantry column; but it is no longer possible to gauge their maximum requirements of speed by horse standards. The demand for increased speed arises from necessity rather than choice.

The House of Commons have discussed the replacement of the internal security garrisons of Mesopotamia and other countries by

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mobile forces of aeroplanes, armoured cars and fast tanks. Whether the project is feasible or not, there can be little doubt that these mechanical arms are destined to play an increasing part in war, and will in time require artillery support.

Two rapid forms of infantry transport were in common use on the Western front, namely busses and tactical trains. When the infantry brigades were moved up to the fight by these means, the divisional artillery could not accompany them. It seems probable that the future may see a more extensive use of such movements in open warfare.

Taking all things into consideration, it is reasonable to demand for field artillery a road speed varying from 2½ to 20 miles an hour, with an average of 12 miles per hour on a fair road.

The cavalry ask two things for their horse artillery: greater mobility and greater shell power. So long as the cavalryman is mounted on a horse, it is clear that his needs in respect of mobility will be more than met by the road speeds suggested for field artillery. It follows that if the 18-pdr. and 4·5″ howitzer are able to move at these speeds, they will also be able to supply the increased shell power, and thus become the horse artillery weapon. In future, then, the design of horse and field artillery machines will be treated as a single problem, eliminating the drawbacks inherent to different patterns of machines, guns and ammunition.

If mechanical horse and field artillery is to be capable of accompanying other mechanical arms, the strategic limit of its radius of action should be equal to that of the arms in question.

At the present moment the fast tank is developing with great rapidity, and it is no secret that the latest patterns possess a radius well over 200 miles.

In the artillery machine allowance must be made for the additional weight of the gun, detachment and ammunition. Reserves of fuel might be carried in the ammunition tank, or if necessary, in one or two carrier tanks.

As a basis for the near future, it is considered that a battery should be capable of covering 100 miles upon its own stock of fuel, and that this distance should be increased as experience allows.

(c) *Road surface.* The roads which the British Army may be called upon to traverse vary from the continental *pavée*, or the kutcha roads of India, to the sandy tracks of Africa, or even Greenland's icy mountains. For such varied travel there are three essential requirements:

(i). The external construction of the machine should be such that its movement may inflict the minimum of damage to the road.

(ii). During a fast run over a rough surface, no part of the mechanism, gun fittings, or ammunition should suffer from vibration. "Sprung" tracks should be a *sine qua non.*

(iii). Equally important will be the ability to cover long stretches of mud or sand on low gears, without undue strain or overheating.

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(d) *Comfort of the Detachment.* The first consideration should be hot and dusty eastern theatres. The ill effects of a closed tank upon its unfortunate occupants are notorious. If drivers and detachments are to be fit for action at the end of a long run, ventilation and seating accommodation require careful attention. It is suggested that ample ventilation should be provided in the sides and flooring, and that the roof plates should be capable of opening, so that, when required, a camouflaged awning may be substituted. Against bullets or water it should be possible hermetically to seal all these openings.

It is for consideration whether engine driven fans and an asbestos lining to the machine might not be provided with advantage.

The seating accommodation should be of some non-conductor of heat, and should provide for comfort and shock absorbing effect, so far as possible.

(e) *Passage of Rivers.* The bridging equipment carried by divisional engineers will take only "light" loads, such as: cavalry in file, infantry in fours, G.S. wagons, horse drawn field artillery and motor ambulances.

For "medium" loads, such as 60-pdrs., 30-cwt. and 3-ton lorries, a heavier type of bridge is required than that carried by divisions.

Assuming that the gross weight of the machine will be in the neighbourhood of 6 to 8 tons, then clearly there are two alternatives.

Either the strength of the divisional bridging equipment must be increased, or the machine should be independent of bridges, that is, capable of swimming.

There are numerous objections to the first alternative, and the latter is therefore to be preferred, if it should materialize as a practical proposition.

Across Country.

If the full advantages of mechanical power are to be realized, the machine should not only negotiate with ease all country over which horse drawn artillery can move, but also such obstacles to wheeled transport as fences, small nullahs, trenches, wire and shell-pocked ground. It is not fitting to offer advice where a wealth of practical experience exists, but to ask only for the best performer over a country that ingenuity can produce.

A discussion of the difficulties presented by swamps, black cotton soil, mountains, rocks, or forests is without profit, for it is clear that in some degree they will remain impediments to mechanical movement, as they certainly are to horse draught.

The cross country speed should yield an average of 6 to 8 miles an hour over a fair country, with spurts up to 12 miles an hour on good going.

In the minds of many artillerymen the greatest bugbear is reliability. If one or two horses in a team fall lame, the gun can still proceed at a reduced speed with four horses, but with the six-cylindered engine a choked jet, a faulty magneto, or a broken wire may bring the whole machine to a standstill. Now, "there ain't no stop! conductor! when a batt'ry's changin' ground", and to be immobilized under shell fire may spell disaster.

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A standard of reliability is required across country equal to that of a motor lorry on the road.

Handiness, or flexibility of manœuvre, should be at least the equivalent of that attainable with horses. A Horse Artillery musical drive is not merely a spectacular display, but a practical demonstration of the standard of handiness required of drivers and horses.

In the first place, a "one-man drive" is essential, and secondly, some means of intercommunication between machines. The latter need will be felt both in action and on the move. It may be that the wireless telephone will provide the solution, but pending its satisfactory development, some form of semaphore or indicator should be provided.

To come in action.

Procedure on coming into action is governed by the relative importance in the circumstances of concealment or speed. With the mechanical gun there will be three methods :

(i). When concealment is the more important, the gun carriage and ammunition will have to be transferred from the chassis to terra firma, whilst the machine proceeds to cover in rear. Conversely, the gun must be remounted again when further movement is contemplated. Speed can never be entirely divorced from this problem, and the whole operation of mounting or dismounting should be capable of accomplishment within one minute. One method by which a field carriage may be readily lifted into position has been described already. The lower the gun platform on the chassis, the more easily will the work be done, and the lower will be the centre of gravity for travel over rough ground. Eighteen inches suggests a height which would allow sufficient ground clearance for the under side of the flooring, and at the same time represent an easy lift.

A more difficult problem will be the rapid removal of ammunition from the chassis. The operation should be simple and speedy, and the ammunition should be protected from splinters and weather after it has been dumped beside the gun.

The removal by hand of single rounds, or even boxes of four, is out of the question.

In some form, mechanical power should be employed to detach and lower rapidly to the ground the bullet proof receptacles containing groups of ammunition.

(ii). When speed is more important than concealment, there will be no necessity to dismount the gun, but fire will be opened from the halted chassis.

(iii). From the preceding situation, no great stretch of imagination is required to development the true combination of fire and movement. Under exceptional conditions it may be possible to open fire whilst actually moving. In the immediate future undue importance should not be attached

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to this function, but it should be held in view for such development as experience may indicate.

In Action.

(a) *Concealment.* If the machine is sent away to cover, concealment of the gun in action presents no new problem.

It is in the second case, when the gun remains in action on its machine, that concealment will be difficult. It has been postulated that this method will only be adopted when speed is the dominant factor, and in such circumstances risks commensurate with the tactical situation must be incurred. The selection of a suitable position amongst houses, thickets, or woods will be all important. The designer can do little to help beyond sloping off the outline, as viewed from the air, and avoiding the protrusion of a long gun barrel.

(b) *Protection.* When the gun is used from the ground it will require its present gun shield, and consequently, this should be retained. Protection of the chassis may be sought by armour, size and shape.

(i). The machine should be armoured against rifle, machine gun and shrapnel bullets, and also against light shell splinters.

Even at sacrifice of speed and radius, the armour should be impervious to the heavy machine gun bullet of some ·5 inch, which the near future seems likely to bring forth.

(ii). The size of the machine will be mainly governed by travelling conditions, first among which will be a length of 24 or 25 feet for obstacle crossing.

Viewed from the standpoint of negative protection, the most important dimension is height. With a ground clearance of 18 inches, and 6 feet 6 inches for the interior, the height over all would be 8 feet.

Every inch reduced should be regarded as insurance against direct hits.

(iii). Experience has shown that a steel helmet will deflect a rifle bullet by its shape, and that German trench mortar bombs and grenades ricochetted off the tank armour before bursting. By the expedient of slanting the roof and sides of the machine, and imparting a streamline outline to its nose, it may be possible to deflect light projectiles before penetration.

(c) *Mounting.* It is necessary to consider the attachment of the carriage to the machine.

Whether it be required to fire on the move or halted, the carriage should ride steadily on the chassis at all times.

To steadiness during fire and movement must be added the necessity for rapid and adequate traverse.

The gun wheels and trail provide three points of contact with the platform.

The attachment of the wheels should safeguard against side-slipping, but at the same time the wheels must be free to move with

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the trail. It is suggested that they might be firmly attached to a revolving base plate, or be given freedom of rotary movement between curved guide plates.

The trail should be capable of lateral movement within the limits of the chassis, but it should be held firm whilst the machine is in motion, and be adequately and evenly supported during firing.

A steel block, faced with thick leather and shaped to receive the spade, might be made to travel in an arc-shaped slot, by the revolution of a large hand-wheel. Details must be left to the designer, but his task would be more simple of solution were the carriage of split trail pattern.

Movement of the carriage would be unnecessary, and four points of contact would be available, in place of the "eternal triangle." The wheels could be firmly clamped to the floor, and the two trails to the side of the chassis.

PART II.

STRATEGICAL ASPECTS OF THE QUESTION.

The three characteristics of mechanical transport which bear the greatest relation to strategy are speed, radius of action, and freedom of movement across country.

It is an old established principle of war to concentrate superior forces at the decisive point at the right time. For the supreme decision strategical surprise is a *sine qua non*, and this factor of success may often depend upon the swift movement of strategic reserves to the decisive point.

Napoleon, who more than any other realized the importance of speed, has said that "the strength of an army, like the power in mechanics, is estimated by multiplying the mass by the rapidity." It is by the inertia of modern masses that the field of strategy has become cramped. If mechanical transport can treble the speed of concentration, then strategic surprise will be more easy of attainment than formerly.

The effects of greater radius of movement will be found in the extension of the field of action of the reserves. If a single day is available for movements, and if in that time the guns by mechanical transport, and the infantry by train, can travel 80 miles, then the strategic field of the reserves will be greatly increased. By the expedient of "milking the line" on either flank of the threatened point, local reserves from a front of 160 miles may be poured upon the scene of action in the same period of time.

The influence of cross-country movement will be found in greater ability to reap the fruits of victory.

In the autumn of 1918, the failure of the British armies to achieve the full strategic results of their victories may be directly traced to the limited radius of action of modern armies beyond their railheads.

The few available roads are rapidly congested to overflowing by the masses of troops and transport, which seek to press forward in the hour of victory.

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If the roads have not been damaged by demolition or shell fire, they become speedily cut to pieces by the never ending traffic.

Thus it came about that an army was unable to operate more than 60 or 70 miles beyond its railhead, and that progress in advance of this distance became dependent upon the rate of rail construction.

The enemy, falling back more rapidly upon undamaged roads and railways, was able to evade those final blows which would have scattered his shaken forces as chaff.

It is in this situation that freedom of movement across country will make itself felt. The power of the strategic pursuit will be increased in direct proportion to the ability to move the artillery masses across country, for artillery, perhaps more than any other arm, tends to block and destroy the roads by its unceasing stream of guns and wagons, backwards and forwards, and by its long strings of horses being led to water.

INFLUENCE UPON TACTICS.

Upon a clear understanding of the characteristics of the new weapon will depend the correct appreciation of its tactical employment in given circumstances. It will be convenient to summarize these characteristics and to note briefly their general effects.

Tactical Characteristics.

(a) *Comparative invulnerability.* From the term "comparative" the following are excepted: mines, aerial bombing, direct hits from artillery and tank guns, and perhaps also from trench mortars and rifle grenades of special pattern.

As a consequence of this partial protection there results the power to drive into action, remain, or withdraw under machine gun and rifle fire.

Immunity from artillery fire will be greater or less according to circumstances.

In action, the risk from direct hits will be slightly increased, since the height of the machine will be greater, but the breadth will be less, than that of a gun and wagon side by side.

On the move, danger from direct hits will be considerably less, for not only is the total target smaller than that of a horse drawn battery, but the speed will be greater.

From shrapnel and splinters greater protection will be afforded at all times.

In general effect increased opportunities will be offered for bold handling, for pushing closer up to the fight, and for occupying and holding positions exposed to small arm fire, and even to unobserved artillery fire.

(b) *Constant readiness for action or movement.* Guns which can fire from a self-propelled platform are no longer defenceless on the march. In a short space of time they can open fire in any direction, move on again, and repeat the process. In all circumstances the guns are ready for action or movement at a moment's notice. Given a secondary armament of Lewis guns, a battery should be independent of escorts.

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When the guns come into action on the machines, a battery will be able to change position rapidly, to reach a crest quickly, or to move to a flank when shelled.

Moreover, from any given position a large extension of the field of fire becomes possible, for the battery can swing on its centre within a few seconds, and bring fire to bear on a threatened flank.

Theoretically, it is possible to do this at present, as it is also possible to reach the crest by the process cynically described as "running up by hand." Those who have manhandled 18-pdrs. up the slope of a ploughed field or the rocky side of a kopje will appreciate the full significance of this change.

(c) *Freedom of movement.* The trenches, shell holes and wire of the modern battlefield, and the hedges, ditches and fences of the countryside will present no obstacle to the movements of the mechanical gun.

The effect will be to make changes of position more rapid by adopting the direct route, and to provide a greater selection of covered approaches. Wagons bringing ammunition to the guns need no longer be confined to known and shelled tracks.

A broader range will be possible in the selection of positions for the guns or wagon line, for the machines will be able to drive into thickets, copses, hedges, or gorse patches hitherto impenetrable for horses.

(d) *Speed.* Speed and freedom of manœuvre will combine to confer greater immunity from shell fire. They will also ensure more timely and constant support of the infantry in all circumstances of a moving fight.

(e) *Fire during movement.* This function will no doubt be the subject of controversy, and it is probable that the earlier machines may fail effectively to develop this power. There is no wish to exaggerate its importance: in fact, at the present time, it is regarded as the least important characteristic of the weapon. There should be no attempt to transform the field gun into a tank proper, but emergencies arise in war which warrant exceptional treatment. That the effect may be more moral than material is of no consequence in the circumstances visualized. It was in such circumstances that Napoleon employed his case shot attack; essentially offensive in nature, and participating almost of the character of shock tactics, it was dependent to a great extent upon the moral effect it produced.

It is possible that opportunities for a fire attack at close range may again present themselves to the battery commander or subaltern bold enough to seize them.

The handling of mechanical field artillery in certain classes of operations will now be discussed.

Landing on an Open Beach.

A study of the Gallipoli operations leaves an impression that a forced landing, in the face of organized resistance, is becoming less and less a practical operation of war.

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So long as the methods are practised by which Julius Cæsar obtained his footing in Britain, the advantages of modern weapons will lie with the defence.

The landing of men and horses in open boats, unprotected from machine gun fire and inadequately assisted by covering fire, has become a superhuman task.

In cases where the superb gallantry of the infantry has enabled them to effect a landing, they have been left to maintain their precarious foothold for many hours before proper artillery support could reach them.

In future operations of this nature it is to be expected that the covering force will be landed in armoured motor lighters of the "K" type, each lighter carrying infantry below deck, and one or two tanks on deck. The method of landing from the "River Clyde" will be followed. Covered by a smoke barrage from the ships' guns, the flat-prowed lighters will make for the shore under their own power, drive straight on to the beach, drop steel ramps from their bows, and disgorge their tanks followed by infantry.

There seems no reason why mechanical field artillery should not be placed on the decks of similar motor lighters, and follow close in the wake of the first flight. It is even possible that they might afford some small measure of support during their passage from ship to beach.

At all events they could be landed under fire, and the very moment the gun chassis waddled ashore they would be "in action," in every sense of the words.

This procedure bears comparison with existing methods of landing men, guns, horses and harness in open and separated boats. In the latter case a deadly pause under fire is inevitable, whilst the disorganized, separated portions of the battery are assembled on the beach and put together for action. C'est magnifique, mais ce n'est pas la guerre!

Mechanical field artillery admits of this bold handling on account of its comparative invulnerability, its self-contained nature, and its constant state of readiness for action.

Offensive Operations.

(a) *The tactical Advanced Guard.* The primary duty of the van guard is reconnaissance, but it should also be capable of dealing quickly with minor resistance, or else the march will be delayed and the main guard unnecessarily fatigued by constant deployments.

In the present day, this minor resistance takes the form of occasional machine guns, which are costly of attack by mounted troops and infantry alone. A few well placed shells, or the threat of tank attack will save endless delays, casualties and fatigue.

This principle has been realized in the new Field Service Regulations, and field artillery and tanks may be regarded as a normal part of a van guard. The old aversion to placing field guns in the van guard was due to their defenceless nature on the march, when inadequately covered by other troops. Penned to the road by the hedgerows, and transformed by sudden attack into a helpless struggling mass of horses, the guns proved a source of anxiety rather than

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assistance to the van guard commander. These disadvantages will not be found in the mechanically propelled gun, and a short consideration of its peculiar characteristics shows that it is eminently suited to van guard work.

In situations where its principal opponents will be the machine gun and rifle, it should be handled with the greatest boldness, using its mobility to close to decisive ranges and direct fire.

With the ever increasing length of the main body, the supply of ammunition to the advanced guard guns has given rise to anxiety. The increased amount of ammunition accompanying the mechanical gun (300 rounds) should materially ease this situation, as will the decreased road space of the divisional artillery. It should be possible for ammunition tanks from the main body to spurt up to the advanced guard guns across country, avoiding the intervening column of troops on the road.

(b) *The Attack.* Two fresh conditions of attack came into prominence during the war:

(i). The great depth to which a modern attack must penetrate in order to secure decisive results.

(ii). The doctrine that each division, brigade, or battalion should push on, regardless of the progress of neighbouring formations.

It was natural that these conditions should affect the action of the supporting arms, as well as that of the infantry.

As the depth of attacks increased, so the necessity for close support of the leading infantry began to affect the machine guns, and later the artillery also, until the use of close support guns became a feature of every attack.

The effect of the second condition was the exposure of the flanks to counter-attack, when the progress of neighbouring formations had been delayed. To guard against this danger a second echelon of machine guns followed the first, being particularly charged with the duty of protecting the flanks. On account of the greater range of artillery, no second echelon was sent forward until the time arrived for the general advance of the barrage batteries. In the meantime the barrage guns were responsible for the protection of the flanks against counter-attack, for the "Division in attack" threw no responsibility upon the close support guns, other than: "The guns advancing in close support must not absolutely limit their action to the support of particular units; the most troublesome machine gun fire often comes from a flank opposite the front of some other formation."

Section 118 of the new F.S.R. Vol II, however, definitely and rightly allocates to the close support guns the duty of dealing with counter-attacks.

The tactics of mechanical field artillery acting in close support would seem to be as follows:—

(i). "The advanced guns must be prepared to engage any hostile guns which impede the advance of our tanks" (Division in attack).

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The essential requirement is rapid action, since each wasted moment will expose our tanks to the fire of the hostile guns.

There should be no attempt to bracket and destroy the enemy guns, but they should be blinded with smoke shell, whilst the tanks close with them. The guns should open fire from their machines without a moment's delay, from a position admitting of voice control.

(ii). "The attack of local centres of resistance" (Division in Attack). For this purpose the armoured motor gun is eminently the superior of his horse drawn brother.

"The guns should be used as weapons of opportunity," and consequently, they may be expected to fire from their chassis, and so retain to the full their mobility in action.

They should be handled with great boldness and occupy more frequently semi-covered or open positions.

The tank proper, on account of its lack of range, shell power, and inability to use indirect fire, can never perform artillery duties, any more than a Lewis gun can supplant the machine gun. On the other hand, situations are conceivable when it might become the duty of close support artillery to usurp temporarily, in their absence, the true functions of tanks, combining their powers of fire and movement in a direct assault upon a machine gun nest.

The situation would constitute an emergency justifying abnormal treatment.

(iii). The third rôle of close support guns will be to guard the exposed flank or flanks, and provide depth in consolidation when the objective is won.

It is to be expected that the counter-attack of the future will be led by tanks, and it is against an exposed flank that its effect will be most dangerous. Direct artillery fire forms the most certain means of repulse.

The power of the mechanical battery to swing quickly to a flank or to reach a crest, and its imperviousness to machine gun fire confer upon it advantages which the horse drawn battery lacks. It is an unfortunate fact that a high degree of anti-tank efficiency will be unattainable, until a split trail carriage or other method of rapid traverse is forthcoming.

Before passing on to the defence, a few words must be said of the barrage batteries, in their relation to mechanical transport.

Their work necessitates the occupation of concealed positions, and, in the earlier stages of the attack, does not demand those properties of protection and mobility which are so vital to the close support guns.

As the attack progresses, the barrage batteries will in turn have to advance; but their movements will not be so exposed to fire, and there will be more time for the preparation of trench and wire crossings.

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During the substitution of machinery for horses, which must inevitably be a gradual process, it is suggested that the barrage rôle should usually be allotted to the horse drawn guns.

From the nature of their duties, too, the initial proportion of mechanical field howitzers need not be so high as the proportion of guns.

The Defensive Battle.

Ludendorff, in his "War Memories," speaks of "*mobile* defence," and he describes the German system "which by distribution in depth and the adoption of a *loose* formation, enabled a more *active* defence to be maintained.

It is thought that the artillery defence of the past has been too rigid, and that the essence of the problem lies in the three italicized words: *mobile*, *loose* and *active*.

Before the attack develops there is no question of the value of counter-preparation, nor at the moment of attack is the value of a defensive barrage to be underrated, under certain conditions.

But once the attack has penetrated the foremost defensive zone, the continuance of these methods by the bulk of the field artillery is contrary to the principle that artillery fire, if it is to be of value to the infantry, should be effective against their immediate opponents.

The breakdown of communications, after heavy bombardment, has repeatedly shown that attempts to pull back the barrage are either ineffective or dangerous.

The following suggestion is based upon the introduction of the mechanical field gun.

A portion of the field artillery should immediately be set *loose*, become *mobile*, and pursue a more *active* defence. Batteries, sections, or even single guns should move to semi-covered or open positions which give a good field of fire over open sights. These positions should cover the battle position, or other localities whose retention is essential to the defence, and when possible they should be previously selected.

The objectives should be the hostile infantry, and so far as possible the leading waves.

The heavy artillery and the remainder of the field artillery should distribute their fire in depth over the attacking troops and reserves, whilst the mobile guns ensure that the leading infantry is continually exposed to artillery fire.

Should the attack be led by tanks, the proportion of guns allotted to the mobile rôle should be correspondingly greater, for "it is the first duty of the field artillery to stop the enemy tanks; all other duties must give way to this" (captured German order).

The horse drawn gun was unsuited to this mobile rôle, because its horses were usually far distant at the moment of attack, its movements were hampered by obstacles, and its extreme vulnerability made hazardous the retention of positions exposed to effective small arm fire. In all these respects the mechanical armoured gun is the superior.

In moving warfare, it is thought that the larger portion of the guns of the defence will be in action on their machines, before the attack develops. In trench warfare, the Germans never succeeded in

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launching an attack on the grand scale, without affording some preliminary indications of their intentions. In such cases sufficient warning should be obtained as will allow the machines of the mobile guns to be called up before the attack develops.

Influence on Counter-Battery Work.

In the long drawn battle of attrition, when counter-battery work is intense, it may be advantageous that batteries which have been located by the hostile guns should retain their machines continuously, with a view to movement if heavily shelled.

The subject is a difficult one, since it involves questions of moral.

It may be opposed on the ground that moral is bound to deteriorate if batteries are encouraged to escape shell fire, but on the other hand, a battery which has been heavily shelled undoubtedly suffers a great loss of moral, as well as serious losses in valuable officers, men, and guns. It is thought that the decision in particular circumstances can be safely left to the commander on the spot.

Should the practice become general, it is probable that aerial bombing may prove more effective than deliberate counter-battery shoots for destruction, in which the chances of obtaining direct hits may be confined to the opening bursts. The neutralizing power of counter-battery work, however, will not be diminished, for if the target moves to escape punishment, the desired effect will have been secured. In trench warfare, the general effect of this power of movement should tend to reduce the heavy, and often unnecessary losses, so heroically endured by the field artillery in the late war.

Space forbids discussion of many other situations. It must suffice to indicate the spirit which should underlie the handling of the mechanical gun at all times.

It is expressed nowhere more clearly than in the precepts which guided the greatest gunner of all time: "L'audace, et encore de l'audace, et toujours de l'audace", and again, "activité, activité, vitesse : je me recommende à vous."

PART III.

MEDIUM ARTILLERY.

The movement of medium artillery on the road by mechanical means is an accomplished fact. The problem of the near future is the extension of these means to include cross country movement.

In strategy, the general effects of the change will be similar to those which have already been discussed.

Experience in the field has evolved generally accepted principles for the tactical handling of medium batteries, including those which are tractor drawn. An examination of varying tactical situations is unlikely to lead to unexplored fields, for it is not to be anticipated that cross country movement by mechanical means will achieve very revolutionary changes in medium artillery tactics.

There remains, then, the mechanical problem. In order to adjudicate fairly upon the application of the different systems of

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transport, it is proposed briefly to examine those tactical requirements of medium artillery which affect the solution of the mechanical problem.

Tactical Requirements.

(a) *Freedom of movement.* Medium artillery, though its howitzers are misnamed "siege", is essentially a field weapon, required to play its part in moving warfare. It is important to bear in mind that the moving warfare of the near future may take place in a country ill supplied with roads, and where tramways for ammunition supply do not exist.

The first requirement is the unhindered movement across country of the 60-pdr. and 6-inch howitzer equipments, together with their detachments and some 100 rounds a gun.

It is in this respect that medium batteries drawn by F.W.D. lorries have completely failed.

To confine the choice of positions to those close to roads is hopelessly to fetter the proper employment of the arm.

The rapidly changing situations of moving warfare do not permit the delay necessary to prepare approaches or to manhandle the guns into position. It seems clear that the capacity of medium guns and their ammunition vehicles to cross natural and artificial obstacles should be equal to that of field artillery. If this need for "self-determination" in movement be admitted, the choice of transport systems will be greatly influenced thereby.

(b) *Radius of action and speed.* From the strategic point of view, radius of action can hardly be too great. As a guide for the near future it should suffice if the radius be equal to that of an infantry bus column, that is some 60 miles a day.

The need of speed is not so great as it is for horse and field artillery, and immediate requirements should be met by an average of 8 miles per hour on the road, and 4 miles per hour across country.

(c) *Protection.* It is not part of the normal rôle of medium artillery to occupy open positions, nor to push so close up to the infantry fight that protection against small arm fire is required. That exposure to infantry fire has been incurred in exceptional circumstances can scarcely be held to justify the addition of weighty armour.

For weapons heavy in themselves, mobility takes precedence of protection, as is clear from the fact that medium artillery are unprovided with gun shields.

(d) *Readiness for action and movement.* Medium guns and howitzers may often be required to engage fleeting targets, but they are seldom used as weapons of opportunity in the same sense as are the lighter guns.

The necessity for concealment more often predominates over speed in the occupation of a position, and consequently, the motive portion of the battery is sent away to cover when the guns come into action.

It follows that the retention of mobility in action, or the power to open fire from their machines, is not essential to medium artillery.

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(e) *Fire during movement.* It is not possible to visualize any tactical necessity for this function.

The Mechanical Problem.

The negative requirements of medium artillery show that it is possible to eliminate from consideration the system of propulsion which has been advocated for field artillery.

There remain the two systems of transport which have been termed "towing" and "carrying", and which have both been tried under active service conditions.

(a) *Towing.* The tactical and technical limitations of the F.W.D. lorry are so great that it cannot fairly be considered as a tractor.

For an example of the system it is necessary to study the caterpillar tractors employed by the heavy artillery, with this reservation, that the ammunition was carried on lorries or tramways, and therefore was incapable of accompanying the gun across country.

Let it be said at once that there can be no insuperable difficulty in the production of a five ton tractor, theoretically capable of towing the gun or ammunition vehicle across country. The difficulty lies in the vehicles to be towed : not in the tractor.

So long as these carriages are of wheeled construction they will be unsuited to a game of "follow my leader" across shell pocked ground, trenches, or natural obstacles. Over bad roads which scarcely shake a track vehicle, the wheeled carriages will be damaged, unless restricted to the most moderate speed. Even were some track device applied to these vehicles, all the inherent weaknesses of towing remain when obstacles have to be surmounted.

It is true that the tractor batteries would be able to cover the same ground as the horse drawn guns, but this achievement would hardly spell progress. It is precisely those limitations to horse and wheel, presented by the obstacles of the modern battlefield, that it is sought to overcome by mechanical means. Other difficulties in the tractor system are the conveyance of the detachment and ammunition across country. The towing of 60-pdr. ammunition wagons or 6-inch howitzer shell in G.S. wagons is clearly impracticable, as is the limitation of ammunition movement to lorry transport.

If detachments and ammunition can be carried in a tank, the advantages will be considerable, and it is wise, therefore, to turn to the system to which these advantages belong.

(b) *Carrying.* No explanation is required to show that this system overcomes all the disadvantages which have been cited against "towing". For this reason the system is sound in principle; its difficulties are solely of a constructional nature.

At Ypres, a machine of excessive weight and insufficient power was tried under conditions which have been admitted to be the most unfavourable encountered by the tanks of that period. The pressing need for a maximum output of fighting tanks prohibited further development of the artillery carrying tank. Since 1917, tank construction has vastly improved, and is now making even greater strides.

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It has been said that the medium artillery machine need not be protected.

In place of a closed and fully armoured tank, *it is suggested* that a bare chassis should be constructed, without roof or sides, and provided with weather protection only for the engine and running parts.

The essential features of the machine would be lightness and adequate engine power. The chassis should carry the gun and carriage, half the detachment, and 25 rounds of ammunition. The remainder of the men and boxed ammunition should be carried on a second chassis, similar to and interchangeable with the gun chassis. In place of sides, a guard rail and steel netting would suffice to safeguard the men and their clothing from entanglement in the revolving tracks. The framework to carry the tracks could be of lattice construction.

The gun carriage should be secured to the floor plates while travelling, but no attempt should be made to fire from this position. The machine should drop its contents in action and proceed to the rear.

The method by which the gun is run in and out of the tank should be simple and rapid; the arrangement employed in the Ypres carrier required about two minutes to operate either way, and is no doubt capable of improvement.

A machine embodying these features is self-contained as regards gun, men and ammunition. Not only does it provide complete freedom of movement, but it reduces to a minimum damage to the equipment and to the roads.

The chassis would provide invaluable transport for material required to strengthen the gun position, when not in use for other purposes. Finally, it may be pointed out that the machine could be used as a tractor at will, and should be fitted with the necessary draught attachment.

Conclusion.

In putting forward this solution of the problem, it is realized that opinion is probably turned towards the tractor. All officers have seen tractors at work, but comparatively few witnessed the carrier trials at Ypres.

There is no wish to assert conclusively that these early trials proved the superiority of the carrier, but rather to indicate the theoretical advantages of the carrier over the tractor, and the general lines on which its development might be sought.

It is urged that before a final decision is taken in favour of the tractor, machines of both types should be constructed and tried out in fair competition, the one against the other.

If the designer will weigh in with steeds of the necessary quality, it will be a privilege to attend this sporting little meeting, and lay the odds—against the tractor.

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FOCH'S PLACE IN HISTORY.

Translated from the "Revue Militaire Générale" December, 1920.

BY MAJOR E. M. HUTCHINSON, D.S.O., R.F.A.

IT may seem to be somewhat rash to attempt to ascribe to Foch his place among the great masters of war when the events with which he is connected are still so recent; but it is not only by the passage of time that one gets the least distorted view of past events; to be able to see them in a true perspective one must also take into account what the future holds in store, and this for the moment is hidden from us.

Let us therefore, in the absence of anything more definite, try to form a judgement by a study of different comparisons, and let us begin by establishing Foch's place among his contemporaries. When we have ascribed him his place in the history of his own time, it will be easier to fix his position in the line of the Great Captains of War. The actions of contemporaries can in fact be examined in relation to each other, because of their simultaneity; they are more familiar to us, and it is not necessary to start with any preliminary comparison of changed conditions. If it is often a delicate matter to compare two different periods, how much more difficult and confusing is our work when we are dealing with mere individuals, however great may be the reputation attached to each of them. . . . . A priori, Victory places Foch in a class above the vanquished. But our investigation takes us further: Foch had assistants, rivals; he did not direct operations alone from the beginning of the campaign to the end; and when awarding the respective honours for this victory, we are prompted by a very natural sense of justice to act fairly towards all those who deserve the full measure of our praise and to whom we shall in due course pay the tribute of our gratitude.

So this task of ascribing to Foch his lawful place consists firstly, in drawing a parallel between him and Pétain, Joffre, and Ludendorff, and secondly in comparing him with those great leaders to whom posterity has already accorded fame.

I. Foch and his Contemporaries.

Foch and Pétain, Foch and Joffre! The three Marshals of France appointed by the Republic, who have erased from our history the dark pages of the 'Empire.' In our hearts all three occupy an equal position: they are equal in the military hierarchy, for they have been considered worthy to receive the highest dignity; they have an equal claim to the respect and veneration of all Frenchmen. This is the view of our people who are imbued with natural common sense; with

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a national feeling of patriotism they associate together the three great founders of our national safety. Far from differing from public opinion it is only our wish here to justify it further, and to strengthen it by laying stress on certain points.

First—Foch and Pétain.

Let us carry our thoughts back to that difficult time in 1917 when General Nivelle had been relieved of his post as Commander-in-Chief of the French Armies, and it was a question of appointing his successor. The choice of the Government lay between Pétain and Foch: the former was selected, and without doubt it is to this fact that we owe our final victory.

"I believe that Providence was very merciful to France," a high and well informed personality once said to us, "when Painlevé in 1917 kept Foch at the elbow of the Government in his capacity as Chief of the General Staff, and placed Pétain at the Head of the French Army. The contrary would certainly have ruined us."—

"Thus," a real believer would say, "the ways of God are unfathomable, and in order to accomplish them he makes use of those who know Him least."

Everyone knows the work which Pétain was called upon to do in 1917. Our army was threatened with dissolution as a result of our failures in the preceeding Spring and of the demoralising propaganda carried on by an unscrupulous enemy.

To prevent the spread of the evil, to restore order in the ranks, and to raise the morale, it required a Commander who understood the mentality of the soldier to its very depths, who had experienced in close touch with his men the difficult and depressing hours of the war, and who had firmly established in their sensitive hearts a reputation for kindness. A leader who was tender and considerate, but at the same time firm, and one who demanded strict obedience to the rules of justice and military duty, such were the qualities which a Commander-in-Chief of the French army at that time needed to possess.

Pétain possessed them in a more marked degree than Foch. He had devoted himself throughout his career to the interests of the piteous infantry soldier whom he loved instinctively; during the war he had shown himself anxious to avoid heavy losses, had been solicitous for their welfare, and had constantly led his men to victory. He spoke their language: his heroic words are the words of the "poilu," short, expressive, and to the point: "On les aura" (we shall get the best of them). At the outbreak of war he was in touch with them as a Commander of an Infantry Brigade; whereas Foch, already in a higher rank, could not live in the same intimate contact with the men under his command. Besides Foch started his service in the Artillery, and the trend of his mind placed him on a higher mental plane, where he was inaccessible to more humble beings; he was removed, except on rare occasions, from the domain of organisation, using the term in its strictest sense. In 1917 what was needed at the sickbed of our ailing army was an eminent physician and not a skilled surgeon.

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From what has been said it will be understood why the selection spoken of above was a particularly fortunate one, and we can appreciate the points of difference between our Marshals of 1918. Each completed what the other lacked. Without Pétain at the head of a French Army, re-organised, disciplined, well instructed, stirred by the purest patriotism and provided with all the necessary material, Foch would not have succeeded in overthrowing the Germans in 1918, even backed up by British perseverance and with the help of the growing American armies.

What matter if afterwards, Pétain, anxious to spare the troops which he had had such trouble to reorganise, *did* show in the critical moments of the fight a caution which to-day may seem to some to have been excessive! This caution at such a time was perfectly warranted. A Commander who wanted to risk all, would probably have called forth from Foch the same kind of observations as we see coming from the pen of Pétain. The tendencies of the one acted as a counterweight to those of the other. So it seems that these two Commanders, closely united in action, with qualities dissimilar, yet complementary, each had a just share in the common victory. Looking at things from different, often even from opposite points of view, the impulses of each were counterbalanced by the character and intelligence of the other.

Secondly. Foch and Joffre.

The latter only just missed being appointed to the supreme command of the armies of the Entente, if not in title, at any rate in fact, because everyone had realised from the very first days of the campaign how important it was, if victory was to be won, to place such dissimilar armies as those of the Allies under one united command. But it was due less to indifference on the part of Joffre than to the ignorance, obstinacy, or timidity of certain Governments, that no real progress was made in this direction while he remained Commander-in-Chief of the French Armies. Indeed, it would have been very difficult for any one of the directing Staffs then in existence to acquire an effective control over the others, on account of the methods of command in vogue. This control, if it were to be gladly accepted by those who were to serve under it, could only be accorded to the Commander of the army whose prestige over his colleagues had been acquired by the effective exercise of his own personal authority. Now at the time when Joffre was responsible for the preparations for war he had concentrated his attention on the organisation of the higher command; he had brought to perfection the German method of collective command, and from August 1914 to the end of 1916 he adhered to a strict application of the methods which had stood their test.

This fact is in itself sufficient to show the fundamental difference which existed between Joffre and Foch; while the former triumphed in the exercise of an anonymous command, it remained for the latter to re-establish the art of personal command. With the first, the General Staff assumed an importance both as regards its numbers and its functions, which was denied to it by the second. Whereas Foch conceives, prepares and draws up the plans for his operations in every

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detail himself, Joffre leaves this work to his Staff, and the intellectual part of the work which he reserves to himself consists solely in rejecting or approving the proposals put before him; others, who are under his direct orders, work out the various combinations, and do the thinking for him. Once he has approved the dispositions prepared for him it is as though he were the author of them himself; he accepts full and entire responsibility for them and demands their strictest execution, which he adheres to with a tenacity similar to that shown by Foch.

This confidence which Joffre shows in the superior ability of his immediate assistants is no sign that he abdicates into their hands any of his prerogatives, nor the least particle of the authority which devolves upon him. Certainly not! He remains the Chief, and all bow before him. No decision is taken without his being consulted. Nothing takes place of which he is not informed. At Chantilly Joffre wanted to know everything, to give all orders, great as well as small, ranging from events of the gravest importance down to the meanest details. Feared by all, he had a kind fatherly freedom of manner which is hard to define, which made him sympathetic and liked. His fits of anger besides being frequent, were terrible, and often based on nothing at all. This man, so cold, so calm in appearance, and a little shy by nature, sometimes showed an uncontrollable violence. With all this, he was jealous of his authority even to excess, obstinate, optimistic, and imbued with a self-confidence which made the most determined shudder.

Joffre's character then presents some striking analogies to that of Foch. Where the two men deliberately part is in the effort they make in preparing their designs; whereas the one conceives them in his own brain, the other leaves them to those whom he knows to have about him, inspiring them with self-confidence, but yet not giving them too free a rein.

What shall be said about the popularity which surrounds these two Commanders? Joffre's has never been surpassed; the first of the French Generals, it was he who defeated the German army. But how much of this is real and how much artificial? To what degree is it the work of that circle of advisers which Foch never had? It is always 'Joffre' the 'grand-pere', the 'grignoteur' (the gnawer) of the Bosch, who is the object of popular veneration in many of the most remote corners of France and even more so, perhaps, abroad: one might almost say that while still living he has stepped into his legend; one wonders if Foch ever will. . . . .

It would be interesting to draw many other comparisons between the two Marshals; their beliefs, their ideas, their feelings, etc. It is natural to want to discover everything about famous men, for this is the price of their glory. But such a study would be premature, and would serve no useful purpose in the present case.

Finally, Foch—Ludendorff.

The influence of external environment on the Commanders we have discussed up to date may have seemed neglible, since it was the same for all of them and their actions were simultaneous.

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On the contrary, a parallel between Foch and Ludendorff should, in the logical sequence of things, begin with a comparison of the different surroundings in which the character of each was moulded and shaped, if we wish to grasp with accuracy the kind of temperament possessed by these two principal rivals of the war.

As a preliminary, let us note that Foch was not opposed by Ludendorff alone, but by the duumvirate Hindenburg—Ludendorff. This idea of collectiveness in the conduct of war is so ingrained on the other side of the Rhine, that even with such an enterprising man as the first Quarter-Master General at least two Commanders were thought necessary. However the authority of Ludendorff prevailed to such a degree over that of Hindenburg—the Memoirs of both confirm this opinion—that it seems we can neglect the latter. Besides, what we know of Hindenburg's character, that of a well balanced old man, with his physical and moral faculties diminished by age and by a long military career which had already reached its term well before 1914, is not in keeping with the risk and enterprise which marked the German operations in 1918; the part which Ludendorff plays is therefore a preponderating one. When Ludendorff disappears from the scene, the high moral courage and patriotism which are Hindenburg's attributes as a soldier, reassert their influence, and he is thus able to organise the orderly retreat of the German troops after their capitulation.

In any case it would be easy in a picture, which might be termed classic and suggestive, to show in what respects the temperaments of the two men differ in their origin. Foch, sprung from that French bourgeois which forms the solid middle-class of our nation, impregnated with its deepseated virtues, endowed with wide learning, brought up in contact with liberal ideas and fertile individual tendencies, his mind widely exercised and active, and yet not distorted by his profession in which he is specialized to the highest degree; Ludendorff, descended from the Prussian Junker class, surpassing himself in all their narrow views, his character tainted with feudalism, tied to a conception of national opinion which was behind the times, confounding the people with the caste in which he had been born, believing the army to be created for purposes of plunder, with the Sovereign at its head.

On the other hand, both have the same vivacity of mind, a wide intellectual culture founded on a deep study of history, an extraordinary capacity for work, hearts bold and full of daring, natures which compel them to action and make them greedy for responsibility, and a force of will which is the product of obstinacy and self-confidence. In short, they represent two ideas which are socially antagonistic, but they are military leaders of the highest order, and worthy to cross swords with each other.

Some clearly defined contrasts are, however, to guide each to his appointed destiny: Foch to the goal of victory, Ludendorff to the Calvary of defeat. While the French leader is imbued with a moderating sense of realities, and instinctively possesses that idea of restraint which never forsakes him, the German Commander loses himself in the clouds, whither he is led by too vivid an imagination and a persistent failure to adapt himself to realities. The war to be

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waged by Germany, as conceived by him, manifestly surpasses the means which he has at his disposal to bring it to a successful end. But that matters little to him! He applies himself to this hopeless task without being able to distinguish the possible from the impossible. With him those qualities of a military Commander which compel success, namely firmness, obstinacy, and the knowledge when to be bold and to take risks, have no counterpoise. He lacks that special 'Flair' which is so necessary for the thorough understanding of the psychology of men, armies and peoples. So he pushes to its limits a war which he would have been wiser to wage with less recklessness. Ludendorff is a mathematician, admirable at figures, but seated at his table poring over his maps, he never notices that his house is falling about his ears. This ignorance of what can and cannot be done gives him the character of a gambler; the more desperate the situation the greater the risks he takes, until the moment arrives when, stupified by his own excesses, he loses all presence of mind and forgets even to preserve that which a nation should never compromise; its honour!

These differences, so marked in spite of the analogies which preceded them, present the two characters in sharp antithesis. The same is true in the domain of 'technique.'

Ludendorff was certainly one of the first German leaders to understand the necessity for simultaneous attacks on the vast battle fronts: it was important to hamper the action of reserves, which on the other hand was favoured by the stabilisation of the fronts and by the enormously increased value of modern methods of transport both for men and material. It is certainly not Ludendorff who would have launched the battle of Verdun on an initial front of scarcely 5 miles. But putting this aside, how much his form of battle is stamped with the indelible German brand, and therein shows itself inferior to that of Foch.

It seems to be a sudden revelation when one follows on a large scale map the succession of events which took place during Ludendorff's offensive from the 23rd March to the 18th July, and on another map of the same size, the series of events which followed on Foch's offensive. One sees in a convincing manner how different the two battles are. The first discloses a series of violent efforts made one after the other, which produced the famous pockets in the Allied line; between these pockets intervals, where the front remained motionless, and between each effort periods of almost complete inaction. There does not seem to be any co-ordinating strategic idea underlying them. After the attack on the 23rd March which brought the Germans to the gates of Amiens, what is the object of the attack in Flanders on April 1st if it is not to be a diversion of a secondary nature with a view to recommencing the battle of Amiens as soon as possible? But no, Ludendorff does not follow out his idea, and turns in May towards the region of the Aisne. In short, his actions are disconnected, in each of them one finds a fresh beginning.

On the other hand, the second map shows us in a methodical and ordered crescendo, a progressive extension of the front engaged. Here, no period of waiting follows a period of violent fighting, everything is combined and co-ordinated: the operation of to-day follows as

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a result of that of yesterday, it anticipates that of to-morrow. The battle progresses methodically, extending its front from day to day.

So, while Ludendorff executes a series of isolated attacks which placed one after the other form a disconnected whole, there is an idea of continuity underlying all Foch's actions; from the 1st of July to the 11th of November his pressure never slackens for a minute. These opposite aspects betray equally opposite conceptions. They are those which one finds at the base of the German and the Napoleonic art of war.

The German prepares his battle before engaging it: he launches his attack with a violence and suddenness which undoubtedly procure for him an immediate and very appreciable advantage. But once launched, he does not direct it; the manner of its development is worked out beforehand, and the intervention of the higher command at a later stage is merely accessory and quite unforeseen; the preparation is expected to be sufficient to carry it through to the final objective; if this objective is not reached, everything has to begin again.

The effort not being prepared in depth, the battle in consequence cannot last, it quickly loses its impetus. It resembles the bursting of a storm which sometimes overwhelms all it meets, and at others scarcely moistens the dried up ground. On the other hand, the French battle resembles those fine rains which begin slowly, last whole days, and without seeming to, soak you to the very skin. Ludendorff stakes his battle on the throw of the dice. Foch directs his battle prudently, distributing his forces in depth from the beginning to the end. So the Allied victory will remain for ever a French victory. It will perpetuate for the future a definite conception of war, the deep roots of which are grafted in the best and most lasting qualities of our race.

II.

Foch and the Masters of the XIX Century.

For the reasons given above, to draw a parallel between Foch, the most recent victorious commander in a war, and those victorious leaders of the distant ages as far back as antiquity, would demand a preliminary survey of a complex and detailed kind. It would in fact be a question of determining the various conditions prevailing at the time when the Commanders acted, conditions which are so difficult of comparison from one period to another. Again, the results arrived at would probably not be conclusive. Therefore, it seems we can confine ourselves to the contemporary period in which war has undergone changes in respect of the material employed but not as regards its ultimate aim.

Here we must particularize somewhat. The period in question opens with the dawn of the XIX Century, following directly on the social upheaval produced by the French revolution. Conflicts of national interests replace those of dynasties, and the change in the ends to be attained produces a radical alteration in the conduct of war. Of course it was always a question of weakening the enemy, overwhelming him, forcing him to sue for peace, and the outward

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appearances are therefore common to all epochs. But this is a little misleading, for around this central fact we find different technical methods which vary in their degree of intensity. To quote only one example, and it is really the most striking: while the Generals commanding armies before the Revolution of 1789 seemed to make every effort to avoid a set battle, and only decided to fight one as a last resort when they had been unable to overthrow their adversary by manœuvre, marching, feints, or occupation of territory, those who found themselves at the head of nations in arms—and Napoleon I as we know was the first of these—sought to fight a decisive battle at the earliest possible moment, convinced that one such victory would win the war. So, if we confine ourselves to those military leaders who were subject to the same professional impulse, and imbued with the same ideas of the end to be achieved in war, we shall have reduced the problem to one of simple comparison between homogeneous parts, in which the principal factors seem to be the social position occupied by each of these commanders and their individual qualities.

The great victors of the XIX Centuary are Moltke and Napoleon, the first the pupil, the second the teacher. How does the victor of 1918 compare with them?

Chief of the Staff of an army to the organization of which he had devoted many years, and which he had fashioned to his own liking, sure of the well nigh unlimited confidence which his sovereign placed in him, and of the support on which he could count under all circumstances, Moltke was able to proceed with his preparations for war with the patience and precaution which a lengthy work demands. He put the instrument forged by his care to the test in a succession of preparatory wars. He applied himself to perfecting the whole machinery of his army, and when the moment arrived he had at his disposal well trained troops, provided with abundant material, led by officers who were well instructed and inspired with high morale, and a Staff imbued with a sound uniform doctrine. It was in particular this Staff, capable of taking the place of the Commander-in-Chief on all occasions when the latter was absent or failed, which constituted a personal triumph for Moltke: later in the vanity of his glory he was to defy his hereditary enemy ever to attain to so perfect an organization.

A policy which was brutally realistic, not to mention the inherent weaknesses in the armies which were to face the Prussian army, also helped to place the greatest chance of success on the side of Moltke. He made a business of war, and in preparing for those contingencies which men most often overlook, he seemed by ingenuity and care to have reached a point where he left nothing to chance. Foch, who has destroyed this fine military machine produced by Moltke and developed by his successors, was not placed in circumstances so eminently favourable; very far from it. Before the war he had only reached a relatively subordinate rank, and if in spite of this he was able to have any beneficial influence on the preparation for it, the effect of this was felt in far too limited a degree by the troops under his command, while his influence on the officers, and that in the intellectual sphere only, was exercised more by the prestige of his teaching than by the authority which high military position confers.

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And again, not only did he not have the chance of exerting his influence in peace time on the French Army as did Moltke before 1870 on the Prussian army, but further, his intervention as Allied Commander-in-Chief occurred at a most critical moment, during the course of a battle in which he had previously played no part, and to which only a disastrous ending seemed possible. The immediate decisions which he had to make did not allow him even the time which was strictly necessary for a thorough grasp of the situation. Is there in all history another example of a supreme command taken over in such dramatic circumstances?

It is certain that if Foch was appealed to at a moment when everything was giving way, it was because he possessed the confidence of the Governments concerned no less than of the army, and the reason for this can be traced back to his firm and vigorous action at the beginning of the war. But the semi-disgrace of 1916 had come on top of that. It is only necessary to recall the interview between Foch and Joffre at the end of the battle of the Somme—[1]"Vous êtes limogé; je serai limogé; nous serons tous limogés. . . ."

In their somewhat crude realism these words express the suspicious attitude of our military leaders towards their dependance on the ruling power of that time. Moltke did not have to suffer such misgivings at any moment of his career.

There was something which absorbed Foch's attention even more at the end of March 1918. The armies of which he received the command were of different nationalities, and there existed between them neither the ties of common origin, nor the uniformity of language, nor that similarity of temperament or preparation which in 1870 bound the contingents of southern Germany to the Prussian army which was the predominating factor. Since 1914 they had remained officially independent of each other; they considered themselves as equals, and the necessary unity of direction had only been obtained up to that time by the good-natured co-operation of their respective commanders. It was just this unsatisfactory arrangement which was the cause of our misfortunes and which Foch had to take steps to remedy; but everyone had become accustomed to it, and it was not to be given up without a struggle. What tact and what subtle diplomacy Foch was to have to display in order that those who felt the new yoke most irksome should not revolt against it.!

Foch and Moltke, therefore, found themselves placed in situations during war which, taken as a whole at least, bear little resemblance to each other, and anyone who had not grasped the sound intellectual composition of the French Marshal's character would be led to conclude that these differences in their respective positions accounted for the divergent methods of command employed by the two leaders. In fact it would be said that while Moltke's authority was exercised by the agency of a collection of individuals duly prepared by him for this object, Foch found himself compelled to have recourse to his own personal ability; he had to act and command on his own initiative; in

[1] The exact translation of "limogé" is "stellenbosched"—Limoges was the town to which Generals were sent who were relieved of their commands at the beginning of the war.

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the absence of any preliminary training or selection he could not delegate to others the right to intervene in his name when dealing with armies which in their turn offered no homogeneity like those of Moltke. To reason like this would be to put a wrong interpretation on the facts. We know definitely that Foch's method of command was not the result of any improvisation, nor was it adapted under any material pressure, and if there is any coincidence it is quite a chance one.

If it were necessary, on the contrary, could we not find many similar ties between Moltke's command in 1870 and Foch's in 1918, which might have driven the French leader to rally to the methods and doctrine of the German commander? Although they were in command of armies they were indeed not situated like Frederick II or Napoleon; however great the confidence which Moltke inspired in his sovereign, there were limits within which he felt he had to keep, and we must not forget that where he was concerned, Bismarck, Roon and many others gravitated in the orbit of King William. Like Moltke, Foch did not have his hands free, and was not complete master of his decisions.

Another similarity—If Foch in command of foreign Generals had to resort to artifices to impose his directing will, Moltke for his part had to take into account the social rank of the Chief Commanders of his armies. Although soldiers, these princely personages could not be treated with that lack of restraint which characterises as between soldiers the relations of the senior to the subordinate. The only commander of a German army in 1870 who had not this advantage of birth, namely Steinmetz, was precisely the last figurant of the wars of Independence, and because of this, Moltke felt himself similiarly tied with regard to him: we see this very clearly at the start of operations in Lorraine.

Further, it would be more exact to say that this sort of subordination to which Moltke found himself subjected, determined him to tolerate the initiative of his army commanders and even to adapt himself to their different points of view, limiting his rôle to "directing operations rather than to commanding, and to taking the past into account only in order to make of it the starting point for a new combination";[1] he acted as though he wished to leave his eminent subordinates to gather all the laurels to be gained on the fields of battle.

With Foch these similarities result in his adopting a diametrically opposite attitude. While Moltke reveals a reserved, extremely cautious temperament, and remains an office-stool commander, Foch on the other hand shows himself under all circumstances a man of action. We are therefore led to conclude that the adoption of different creeds by these two commanders is due to a glaring disparity, both in the quality of their character and in the power of their intelligence.

Foch himself, better than anyone else, has shown us in his books what was lacking in Moltke's art. Forgetting that "strategic security" is exclusively the concern of the supreme command, the victor of 1870 only took "tactical security" into account, which places the "technique" of his execution on a much lower plane than that of Foch. This inferiority is especially evident in the direction of a battle.

[1] Foch. "De la conduite de la guerre" pages 395 and 183.

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Moltke leaves this direction, which he ought to make his own concern, to the impulses of subordinates, and "shows himself powerless by his personal action of infusing life into a combination which is his production, but which is imcomplete in its organization."[1]

He commands intermittently and from day to day. The 'army' organization which he introduced in time of peace seems to him too cumbrous to handle when it comes to execution on the ground; he then pretends to forget its existence, and directs and controls himself the movements of Corps. His foresight is not sufficiently accurate for him to be able to place his subordinates on the right path early enough, and if by chance, the latter, anxious to be informed of the views of the higher command so as to regulate their own actions accordingly, dare to ask him any questions, Moltke, doubtless because he has no answer to give, envelopes himself in mystery and remains laconic. His ideas, which he communicates to the executants in short telegrams, only reach them in scraps.

What a difference we find in the open character of Foch's orders; these will remain as models of their kind, and are themselves only the confirmation of verbal directions given at interviews with his army commanders. He looks ahead as far as possible, raises himself as high as he can, indicates the nature of the operations to be undertaken, and in this manner stretches out a wonderful thread, like Ariadne, which will guide each through the maze of daily events. But he does not restrict himself to this rôle, he presides at the execution, he superintends, he claims for himself a share in the action. In his position as supreme commander, he always tries to keep in view two essentials which Moltke often missed. First of all, good information, and for this he avails himself of all the means of intelligence which he turns to his use with the greatest skill; secondly, the power to act, that is to say, having the time to prepare his operations, and being able to carry them out in perfect safety by bringing his units into the fight progressively, distributed in depth, and always retained in his own hands.

So Foch comes nearer to Napoleon than Moltke ever did, in spite of the wonderful profit which the latter derived from the Emperor's teachings.

It is certainly no question of belittling the reputation gained by Moltke, and Foch would be the first to be opposed to such an attitude. He appreciates him at his true worth, and to use his own words, the results which Moltke was able to achieve "have not been surpassed in history." But it must be said that this statement of the Marshal, made before the war of 1914-1918, could not longer be upheld to-day. But however that may be, let us confine ourselves to remembering with Foch that Moltke in his superiority over his adversaries, the Austrians in 1866, or the French in 1870, shows himself a sage "who places his vision on a level with his means," and "who in the realisation of his conception appeals to common sense, sound reasoning and not only to military resources."

But how far from that to the genius of Napoleon! "From the latter," says Foch, "we get quite a different idea of war, and also the

[1] Foch. "Conduite de la guerre" page 178.

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impression of a stronger and more intimate union between a more powerful brain, a more energetic will, a more supple army and a better planned organization."[1] When it is a question of Napoleon, Foch's admiration knows no bounds, and this profound well-considered admiration is the result of deep study. Foch has taken him as his exclusive model in his doctrine of war and in his method of command. Further, he has been able to realise that in this last there is much that is perishable, and he has analysed the reasons why Napoleon, in spite of his greatness, failed in the direction of his armies in 1812 and 1813. In this way he found himself directed towards the scientific character of modern war, and towards the necessity for making use on a large scale of the new improvements in liaisons, transport and the engines of war. But what Foch has completely retained and put to the best use on his own account is the personality and driving force of the commander in the Napoleonic wars. The Commander-in-Chief alone "is the composer and conductor of the orchestra, the others only form part of this orchestra." Putting this maxim into practice, Foch showed himself much more a man of action than study. Did he not say in 1920 that "study is rarely sufficient to fill the life of one who is capable of action, and anxious to serve his country?"[2] Let us further note in this parallel between Foch and "the imcomparable Master" the similar qualities of character; an ardent desire for responsibility, that internal effervescence of ideas which betrays itself in spite of a silent attitude often common in both men, boldness of resolve, constancy and strength in execution, a stubborn mind, a passionate will.

After the analogies the contrasts.

They are stupendous and are explained by the huge disparity in the positions occupied by each. Let us note to begin with, that if with Napoleon intellectual accomplishments come after achievements, on the contrary with Foch they precede them; his deeds follow his teachings, and thereby give to the theories he has explained a power of justification and a force of consecration which have never yet been reached.

Secondly, in 1796, Bonaparte, 27 years old, has nothing to lose and everything to gain; in 1918 Foch is 67, and it is only the war which has kept him on the active list, a reward for the precious services he rendered in 1914. His harvest of glory, although gathered quickly and so recently, is nevertheless already considerable, and if the year 1916 did leave a touch of bitterness on the Marshal's heart, it in no way compromised him.

Would it then not be better to leave things in that position? Is he likely to gain anything in 1918, and is he not running the risk of compromising his past achievements? Another might well have reasoned after this fashion. But the desire for action which animates Foch in 1918 is such that this old man appears to us as young and full of life as the Bonaparte of the campaign of Arcola. To get a more exact appreciation of Foch's physical and intellectual activity we ought rather to compare him to Napoleon at the end of the Empire . . . . the

[1] Foch. "Conduite de la guerre" page 223.

[2] His speech on being admitted to the Academic Francaise.

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truth is the two men had not led the same strenous life. Napoleon's powers were exhausted by the great deeds which form his dazzling Epopea; his shoulders were bent under the crushing weight of absolute sovereignity; the impulses which urged him on acted with tenfold force because they were personal and egoistic, and made him "master of the world but not of himself."

What distinguishes Foch on the other hand is his great moderation; at the age when he became a supreme military commander great personal ambitions become chimerical. Further he does not place his sword at the services of a discredited Directory, but works in concert with a Government which has been firmly established for half a century, has proved itself since the beginning of the war, and by good chance is at that very moment in the hands of a real leader of the people. Sincere believer and disinterested patriot, adapted by birth to his social environment, Foch could not dream of re-building the world from top to bottom, he could only think of saving the world he was accustomed to. That is why he will abandon all vain conceptions, and like those providential heroes of whom Carlyle speaks, will adhere to realities. He will always take his stand on facts and not on appearances.

Foch, remaining a man among men, will probably never have his legend, but it would be unjust that this should mar the brilliance of his name or the glory of his military renown. For in the exclusive domain of the art of war, incontestably greater than Moltke, he will remain the military commander of modern times who can be most closely compared to Napoleon, the model; he has surely approached him nearer than anyone else.

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SURVEY WORK IN MODERN WAR.

BY MAJOR M. N. MACLEOD, D.S.O., M.C., R.E.

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ALTHOUGH training in "Military Topography" is part of the curriculum at both Woolwich and Sandhurst, it is to be feared that the meaning which the word "Survey" conveys to the average officer often bears only a remote relationship to what it really is.

The impressions he carries away from these institutions, if he carries any at all, associate it with map reading and "field sketching" only.

Most officers retain this impression unmodified through the rest of their service, and regard survey work in relation to military operations solely from the point of view of the maps and mapping indispensable to any war.

Survey and map-making are, however, not quite the same thing; nor, as will be seen later, is the connection between survey and war by any means confined to maps.

Survey may be defined as the exact measurement of the distances apart, relative heights, and mutual directions of terrestrial objects; mapping as their representation in pictorial form on a piece of paper.

Survey deals with the measurement of angles and distances in situ and supplies the data from which maps are afterwards prepared in an office. Its application to mapping is old, but its application to military operations, outside the question of maps, is a new thing, initiated and developed during the Great War just concluded.

The growth of the survey organization of the B.E.F. can hardly have been equalled, must less surpassed, by any other branch of his Majesty's forces, not excluding the R.A.F. and the R.A.S.C.

The survey "staff" of the original B.E.F. consisted of one G.S.O. II and one clerk. At the time of the Armistice it comprised in round numbers 400 officers and 6,000 other ranks, an increase of some 300,000 per cent. Even with these numbers the survey organization was seriously under-manned, and had the war continued even a few months longer it would probably have been found necessary to augment them considerably.

Even as things were the numbers would have been greater had it not been for the acuteness of the "man power" difficulty after March 1918, when new establishments were under consideration. From that time onwards there was a certain reluctance on the part of the A.G.'s branch to find additional men for any but the principal fighting services. Nevertheless, it is probable that the men employed on survey work, although not one of them fired a rifle, a bomb, or a gun, or committed in the course of their duties any similar act of frightfulness, contributed to the final undoing of the enemy in as great a degree as those of any other branch of the service.

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Little has been heard of what they did and still less of how they did it, although they served many masters. Even at this time the number of officers who really understand the full significance and details of their work is very small. The ordinary officer on reading the figures given above may be tempted to exclaim "What on earth did they all do?"

In this article an attempt will be made to give the answer to this question.

Survey work in the B.E.F. was carried out by units known first as "Field Survey Companies," and afterwards, as their numbers increased, as "Field Survey Battalions,"[1] of which there was one for each army and one at G.H.Q.

The duties of these battalions may be divided into three more or less distinct categories, all of which depend directly, but in a different way, on survey, that is on the measurement and determination of distances and directions.

These categories are :—

(1). The provision of fighting maps.
(2). The location of targets for the artillery.
(3). "Map shooting" (known as "predicted shooting") by the artillery.

Each of these involved an organization and methods for which there was no precedent. Each had to be built up from virtually nothing at all.

The fact that at the end of the war the British Army was almost certainly ahead of both its allies and its enemies at all three, is a striking testimony to British powers of improvisation and practical capacity.

That no proper organization for survey work existed in the British Army in 1914 was due to the fact that at that time mapping, particularly large scale mapping, was a slow and laborious process which could only be done by going over every yard of the ground on foot. The possibility of making maps during the course of any operations, and especially maps of territory occupied by the enemy, was so fantastic that it had not been contemplated.

Nevertheless, this was the first problem which our survey officers were called upon to solve after the Battle of the Aisne in 1914, and which they had virtually solved by the end of the next year.

It is a problem which will probably have to be solved again in the next war and in a more difficult form, for there are very few countries in the world which have yet been accurately mapped on so large a scale as even 1/20,000.

It may be argued by some that large scale maps are an attribute of position warfare and that, for that reason, the need for them should be exceptional. This view is unsound for several reasons. The most

[1] NOTE:—A Field Survey Battalion consisted of a Headquarters Section some 200 strong, dealing with survey and mapping, and from four to eight "Sound Ranging Sections," each about fifty strong, and the same number of "Observation Groups," each about seventy strong, and three to six Corps Topographical Sections (one for each corps in the army) of some ten or twelve men each. The average strength of a Field Survey Battalion may be taken as about 900 all ranks.

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important of these, and one which is probably decisive, is that unless an accurate, large scale, gridded map is available, co-operation between aircraft and troops on the ground becomes exceedingly difficult, if not actually impossible.

One of the most important functions of aircraft in war is the location of hostile forces and of our own forward troops. An aerial observer can only "locate" these with reference to topographical features on the ground in their immediate vicinity. If there are no such features, or if they are not shown on his map, he has no means of locating anything at all; nor, even if he could locate something, could he accurately and quickly transmit the information he had acquired to troops on the ground who have to act upon it.

On a small scale map, that is to say a map on a scale of one inch to one mile or less, all but the main topographical features have to be omitted because there is not room to show them on the paper. Location of anything from the air on such a map, which necessarily bears little resemblance to the appearance of the ground, becomes very difficult and cannot be more than approximate. Approximate information is, however, of little use in modern fighting. It does not, for example, help a battery commander to know that the front line is about 300 yards south or north of a certain point. His F.O.O. can probably tell him that without assistance from the air. It does not help him much to know that a hostile battery is firing from some point which may be anywhere in a circle 500 yards across.

Such information is perhaps better than none at all, but if one side has to rely on this, while the other, with the help of a better map, can obtain it ten times more accurately, there is no question but that the latter gains an important advantage.

Before the war it was the considered policy of the General Staff to train troops to work with small scale maps. Our "tactical" map was the "half-inch" (two miles to one inch). The use of large scale maps was discouraged, on the grounds that they would not be available in war.

There are probably some conservatives who consider that we should revert to this policy. It is noteworthy, however, that even during the comparative mobile operations at the end of the war, the fighting troops almost invariably asked for the largest scale map which was available.

The fact is that a small scale map, such as the "half-inch" or the 1/100,000, is a *manœuvre* map, useful for the movements preliminary to action when troops move in formed bodies. When it comes to a stand-up fight something larger is required; the larger the better, provided it can be carried about and includes a sufficient area on a single sheet of paper.

If full advantage from the map is to be obtained, the scale should be somewhere round about 1/25,000 or 1/20,000 at least, and the survey organization should be prepared to supply this.

Can this be provided under all conditions and circumstances?

It is probable that it can, though this is as yet by no means certain.

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The process of mapping can be divided into four parts :—

(*a*) Fixing of a certain number of selected points as a sort of skeleton or framework on which to build up the details of the map.

(*b*) Filling in the "detail" between these points and fitting it to them.

(*c*) Fair drawing.

(*d*) Printing.

Each of these constitutes a separate operation which cannot be commenced until the one above it is finished.

The "control" points which form the framework of the map are generally fixed by a process known as "triangulation." They are chosen so that the lines joining them form a network of triangles covering the area to be mapped. At each point the angles of these triangles are measured with a theodolite. When two of the three angles of a triangle have been determined the lengths of all the sides can be calculated if any one of them is known.[1]

The process starts with one initial measurement along the ground between two selected points and an astronomical observation to determine the direction of one from the other. From these two things, and from the observed angles of the triangles, the mutual distances apart and directions of all the other points can be calculated, and their relative positions determined with great accuracy.

Having fixed a sufficiency of points in this way the "detail" is then filled in. Before the war this could only be done by surveyors working over the ground bit by bit. Aerial photography, which was started in 1915, has however introduced an alternative method which is of particular value in war, in that it can be applied to areas occupied by the enemy which the surveyor on foot cannot enter.

There are, however, certain difficulties to be overcome in the use of air photos due to the fact that it is not at present possible to ensure that the camera is always pointed perpendicularly towards the ground.

When this is not the case the ground will be viewed in perspective, and its image on the plate distorted, so that a map traced or copied directly from the print will be inaccurate.

There are various ways in which this distortion difficulty can be overcome, but it is not as yet certain that the methods hitherto employed for overcoming it can be applied everywhere, as most of them postulate a certain minimum of ground survey work for fixing "control" points, analogous to and supplementing the triangulation framework referred to above.

It is sufficient to say that our survey services in the future will probably have to be prepared to produce quickly large numbers of accurate large scale maps of any theatre of operations immediately after the outbreak of war.

This will require a fairly large staff, as the work must always be done against time, and a considerable quantity of heavy and intricate machinery, which must be kept "on the spot" and carried about if necessary.

[1] NOTE.—It is, of course, preferable to measure all three angles of a triangle when it can be done, i.e., when all three points are accessible.

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The next, and perhaps the most interesting, of the functions of survey work in war is the location of targets for the artillery.

Before the war virtually all artillery shooting depended on the target being visible from some point or other in our own positions. The approximate range of the target was measured with a range-finder and the gun laid on it, either over the sights, if the target could be seen from the gun, or by means of a compass. Both range and direction were checked and corrected by observing the fall of the first few rounds.

Very soon after the commencement of the war it was found that the universal adoption of "indirect" fire by the artillery of both sides made it impossible to attack the hostile guns in this way.

Ranges could not be measured at all, as the guns could not be seen from our lines; nor could they be located, although they could be seen, from the air, as no large scale map was available.

Even when suitable maps became available there were still many difficulties to be overcome.

Aeroplane observation, even when a good map is available, has more limitations than are generally realized. It can, for example, only be used by day and then only in reasonably fine weather.

Nor is it always a very accurate means of "locating." If the hostile battery does not happen to be close to some feature marked on the map the observer must estimate its position by eye alone. How difficult it is to do this accurately is easily tested by trying to transfer the position of an object in the middle of a large field on to a map from an aerial photograph without the aid of instruments.

It is true that an aerial observer on seeing an hostile battery can "call up" one of our own batteries and, having reported the approximate position, can "range" the battery on to it; experience, however, shows that this procedure is not so easy as might be supposed and is not infrequently unsuccessful.

Some other means of observing hostile artillery is obviously desirable—preferably one which can remain ready for use and action all day and all night, so that at whatever time a hostile battery opens fire it can be at once located and if necessary attacked and silenced.

Two methods of doing this have been evolved during the war—they are known as "flash spotting" and "sound ranging."

The first consists in fixing the position of the flash of discharge of a gun by observations from accurately surveyed observation posts in our own lines, and the second effects the same thing by observations made on the sound "wave" in the air caused by the explosion of the charge.

The principle of fixing the position of an object by means of intersecting "rays" observed from surveyed stations in our own lines is, of course, very obvious and well understood, and many "inventors" came forward at different times with methods and apparatus for doing so.

With hardly an exception, however, all failed to grasp the true nature of the problem. The flash of a gun is generally most conspicuous by night when no other objects to guide the eye can be seen, and it then appears only for an instant. A ray or "bearing" to it

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cannot, it is true, be accurately observed with a compass or ordinary surveying theodolite because such observation depends on being able to intersect it with the cross-hair or other sighting arrangement of the instrument, and this is admittedly difficult, if not impossible, at night.

Provided, however, a suitable instrument is available, that is to say one having a "graticuled" eye-piece with means of illuminating the graticule, this difficulty can easily be surmounted.

The real problem of "flash spotting" consists, not in actually observing the flash, but in selecting successively one particular flash out of many which appear, and in ensuring that all observers, who must necessarily be placed a considerable distance apart, take their observations to that one. This problem is much more difficult and for some time defied solution. It was solved early in 1916 in the following way.

Instead of allowing each observer to select his own flash, the observation stations, known as flash-spotting posts, are worked in "groups" of from three to six. All the flash-spotting posts in each group are connected by telephone to a central headquarters or plotting-centre from which the observations of each are directed and controlled, and where the results are worked out.

The control is effected by means of a special pattern of telephone exchange and a specially arranged plotting board, which enables the officer directing the work first to select any particular flash out of several visible, then to direct or concentrate all his observers towards it, to know when all have "picked it up," and finally to quickly work out the results of their observations. Without going into details of the equipment and procedure it may be said that the method of control now in use, when worked by well-trained detachments, enables a hostile battery to be located with precision and certainty after five or six rounds have been seen.

The degree of accuracy obtainable depends principally on whether the actual gun flash or only the glow or sky reflection of it can be seen. Flashes from howitzers or anti-aircraft guns rise to considerable heights in the air and seem to cause a certain amount of "searchlight" effect, enabling them to be detected at night even when they are defiladed two or three hundred feet below the crest of a hill.

High-velocity low trajectory guns cannot generally be sighted in deep valleys, as the shells have to clear the crest in front, and are therefore equally difficult to conceal even though the flash does not rise so high in the air.

In favourable circumstances it is easy to "pin point" the position of each gun of a hostile battery in this way to within twenty or thirty yards of its true position, up to a distance of 5,000 to 6,000 yards from our own front line. At greater distances the precision of the location naturally decreases, but, nevertheless, even at extreme ranges the locations are generally quite accurate enough for our own artillery to take effective action on them.

(A "flash-spotting" group, for example, working in the Nieuport sector in 1917 located a battery of coast defence anti-aircraft guns at a distance of eleven miles behind the German lines. Their location

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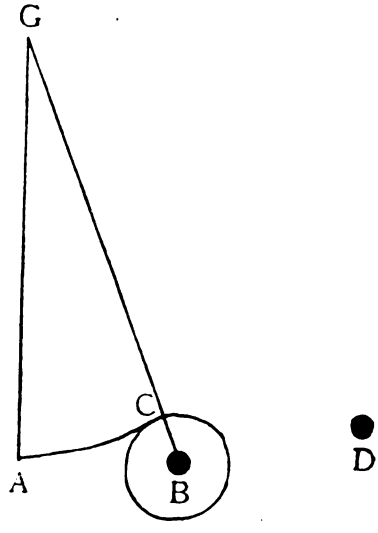
proved to be within sixty yards of the true position, as determined from an aerial photograph of the same battery).

"Flash spotting" of course depends for its operation absolutely on good visibility. In foggy weather it cannot operate, and when the terrain is unfavourable and suitable observation stations cannot be found little use can be made of the method.

Sound ranging, on the other hand, is at its best in foggy, still weather, and is moreover practically independent of topography. It is, however, very dependent on wind.

To explain the principles of sound ranging it is necessary to refer to a diagram :—



The discharge of a gun causes a "vibration" or "wave" in the atmosphere analogous to the ripple caused by throwing a stone into a still pond. In still air this wave travels outwards from the gun in all directions at an approximately uniform velocity which is fairly constant at any given temperature, and is known within fairly small limits. This velocity is about 370 yards a second at 50° Fahr.

The position of this wave at any instant is known as the "wave front," and since the wave travels with a uniform velocity in all directions the form of the wave front at all times will be approximately a sphere and its intersection with the ground a circle.

Suppose now that "G" is the position of the gun, and "A" and "B" are two points in our own lines at which have been placed instruments which will detect and record the arrival of a sound wave, and that "A" and "B" are connected to a timing apparatus which will record the interval of time which elapses between the arrival of the sound wave successively at each.

When the sound wave reaches "A" the wave front is represented by the circular arc "A-C." It has to travel the distance "B-C" before it reaches "B." The timing apparatus will record how long

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SURVEY WORK IN MODERN WAR.

A DH 9 carrying out photographic work 6,000 ft. above Antoing, near Lille, during the War. The craters on the railway lines are very distinct, as also a hospital amongst the trees and the pontoon bridges across the Scheldt.

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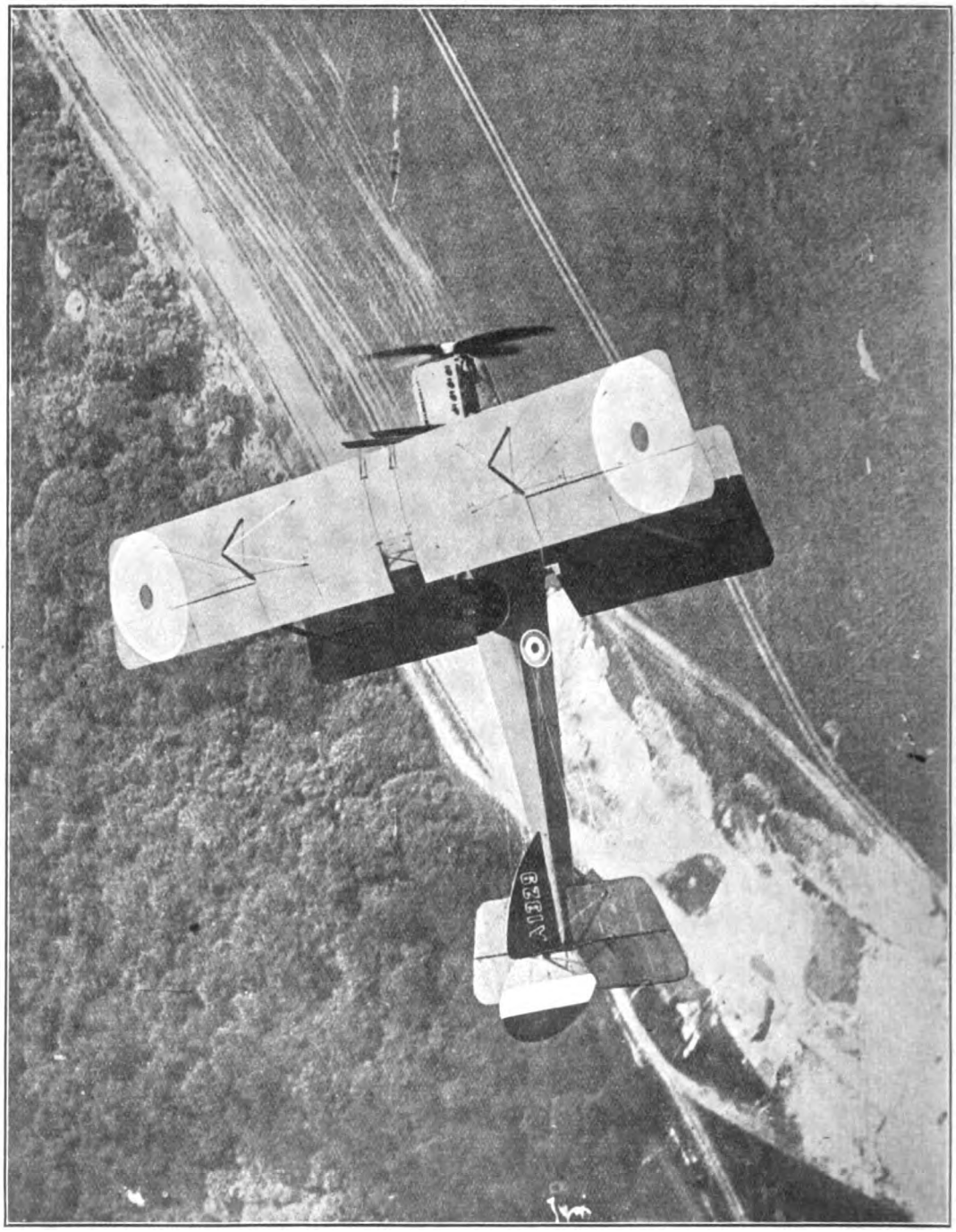

SURVEY WORK IN MODERN WAR.

A BE 2E in flight, a useful type of machine both for directing Artillery shoots and for photographic work.

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it takes to travel this distance and, since the velocity of the wave is known, the length of "B-C" can easily be calculated.

Suppose this recorded time interval to be one-tenth of a second. The velocity of sound being, say, 375 yards a second at the particular temperature prevailing, if the air is still, the length of "B-C" will be 37·5 yards. Describe a circle of 37·5 yards radius round "B," using "B" as centre. The centre of any circle which touches this circle and also passes through "A" is evidently a possible position for the source of the sound.

All such centres lie on a certain type of curve which approximates more and more closely to a straight line the farther it gets away from "A-B." At the distance at which hostile batteries usually lie this curve may be regarded, without appreciable error, as a straight line passing through the mid-point of the line "A-B." The direction of this line can be calculated by a very simple formula derived from the length and direction of "B-C," the time interval recorded by the apparatus, and the known velocity of sound.

Suppose now a third detector, "D," is placed in position and also connected to the timing apparatus. The latter will now record three "time intervals," namely, the time which elapses between the arrival of the sound wave successively at "A-B," "B-D" and "A-D." These time intervals give three lines which should intersect at one point. This point must be the origin of source of the sound.

In practice the time interval "A-D" is not used, but three more detectors or microphones are employed and the time intervals between adjoining microphones only are used, giving five lines intersecting at the position of the hostile gun.

These lines can be quickly laid out on a specially prepared plotting board.

The microphones are generally set out at equal intervals, which may be anything from about 1,200 to 1,800 yards.

Each microphone has to be connected by an electric circuit to the timing apparatus and its position very accurately surveyed. The time intervals are recorded automatically by an apparatus set in motion electrically by a "forward observer," so placed that he can hear the sound of a hostile gun in any given locality a second or two before the sound reaches the line of microphones.

In plotting the results allowances or corrections have to be made for wind and temperature. Sound, being a vibration in the atmosphere, is affected by wind which moves the atmosphere bodily in one direction. The velocity of sound where there is any wind is not therefore uniform in all directions. It travels both faster and farther with the wind than against it.

When the wind is steady the wind correction can be made with considerable accuracy, but it more often happens that the wind blows in gusts and its velocity varies from minute to minute, while its velocity some distance up in the air is greater than that on the ground. When this is the case the wind correction can only be made approximately and the accuracy of the location suffers in consequence.

In spite of this, however, it is generally possible to locate the position of a gun by sound, whenever it is possible to obtain a sound

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"record" of it, to within 100 yards of the truth, up to a distance of 5,000 or 6,000 yards from our front line.

When the wind is blowing directly away from the microphones towards the gun it is seldom possible to obtain a record. Sound does not travel far against a wind along the ground, and in an adverse wind it is virtually impossible for all the microphones to detect a hostile gun report.

The inability to work in an adverse wind is the greatest drawback to "sound-ranging." The only other serious difficulties which have to be overcome are due to the fact that the microphone, unlike the human ear, can only discriminate to a limited extent between the *quality* of different sounds. It records all sounds of a certain type, and therefore records the sound of all our own guns as well as those of the enemy. It may easily happen that after the sound from "G" has reached "A," and before it reaches "B," a similar sound wave from some other source reaches "B" and there will be two "time intervals" recorded by the timing apparatus, one given by the wave "A-C" reaching "A" and "B" and one by the wave "A-C" at "A" and the other wave at "B."

The use of six microphones instead of the minimum possible (i.e., three) is chiefly due to this trouble. If several "records" of the same gun are taken, clearly the five "time intervals" recorded on each will be identical, whereas it will be an impossible coincidence for the intervals caused by other sounds to be the same on all. Except in very heavy bombardments a skilled man can generally select the particular intervals required from a series of four or five records of the same gun, though it may take a little time to do so.

With the present apparatus the time taken to work out and plot a single record where there is no doubt about the intervals, is about five minutes. When there is much 'interference," caused by reports of other guns or shell bursts, it may take half an hour or more; depending on the skill and experience of the man working out the record.

Once, however, the records have been taken it is generally possible to sort out the "intervals" and arrive at the correct location. It is perfectly feasible, for example, to locate four or five guns at the same time, i.e., from a single series of records.

It is in this that the special advantage of the sound ranging method lies. In flash-spotting the guns have to be located one at a time; until one has been marked down attention cannot be given to the rest. In sound ranging the observation is automatic and the record is virtually instantaneous. It is theoretically quite possible to record as many as ten or more at once, though it would take some time to sort out so many "intervals" as this would cause on the record.

Like flash-spotting, sound-ranging requires an elaborate system of electrical wiring. The microphones are generally, as explained, placed about 1,200 to 1,800 yards apart, and each has to be connected to the central H.Q., where the time recording apparatus is kept, by an electric circuit of very well insulated low resistance cable. This necessarily takes a certain time to set out, and cannot, of course, be maintained if it is placed too close to the front. In spite of this, however, the use of these methods need not be confined solely to

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position warfare. The laying out of the cable and microphones for a sound ranging section can be done by a well-trained detachment in eight hours, while flash-spotting sections have got ready for action in three to four hours.

Except, therefore, when movement is rapid and continuous, there will always be ample opportunity for their use. Much valuable work was done by them in the battles of September and October, 1918, even though all sections were very short of men, and still more so of transport, which made it exceedingly difficult for them to keep up with the advance, quite apart from the necessity of laying lines or surveying their observation posts and microphone positions, which is generally the slowest part of the installation.

No very accurate statistics have been kept of the number of locations effected by the various agencies employed on the location of hostile batteries, but it is probable that during the period of position warfare in France the number of hostile batteries detected and marked down by flash-spotting and sound-ranging sections was at least three times that located by observers in aeroplanes and balloons, and it is noteworthy that as a rule their locations proved the more accurate of the two.

There is no valid reason why equally good results, given adequate personnel and transport, should not be obtained in more mobile warfare, such as that which characterized the concluding stages of the war.

When "location" work is not required both methods can be used for ranging and "calibrating" our own guns, for which purpose "flash-spotting" in particular gives very good results.

The "calibration" of guns is another modern development due to the Great War which is intimately connected with survey work, particularly map shooting, the third use to which survey work has been applied.

In order to hit his target the gunner must not only know the exact range and direction of the target, but if he cannot correct his fire by observation, he must also be able to lay his gun exactly in the direction of an object he cannot see, and to know at what elevation it must be fired to attain the required range.

The correct "elevation" at which to lay a gun depends primarily on its muzzle velocity, which in its turn depends on a number of factors, such as wear of the bore of the gun, temperature of the charge, nature of the projectile, and so on. A determination of the muzzle velocity has to be made from time to time. This can be done in various ways, and is called "calibration." It is a gunnery rather than a survey matter, which need not be described here.

Exact measurement of distance, or range, and direction are, however, the ordinary business of the surveyor who, for any particular job, only requires to know the permissible limits of error in his work. It was not long before his services were enlisted by the gunner.

At first these were confined to the preparation of a special fighting map for each battery known as an "artillery board" or planchette.

This consisted of a plain map or "grid" mounted on a special board on which the exact position of the gun, as fixed by a surveyor,

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was plotted, together with an accurately graduated arc, enabling angles from the battery "aiming point," or other suitable zero, to any target plotted on the board, to be quickly read off.

The map or grid being on a large scale, generally 1/20,000 or 1/10,000, any range could be scaled off correctly to within fifteen or twenty yards.

In this way the gunner, by plotting his target (as located by flash spotters, etc., or in other ways) on his artillery board, could find out the exact range and direction of his target without any of the preliminary "registration" invariably required by former or previous methods. The introduction of the artillery board in 1915 undoubtedly effected an immense improvement in the accuracy of our shooting. Still more, however, remained to be done, for although the board enabled the exact range and direction of the target to be determined, it was still necessary, when the latter could not be seen from the gun position, as was almost always the case, to lay or point the gun accurately in the required direction.

When the target cannot be seen from the gun position this laying has to be done off an "aiming point" which can be seen from the gun, usually either behind it or to one flank. It is necessary to know the angle at the gun between the line to the target and the line to the aiming point. The gun-sight is so constructed that when this angle is set on it, and the sight laid on the aiming point, the gun points in the direction of the target.

To understand how accurately this angle must be known it may be pointed out that an error of only five minutes in laying the gun for direction, or "line" as it is termed, will at 10,000 yards throw the shell to one side or other a distance of fifteen yards.

To this error must always be added an error of perhaps another fifteen yards or more caused by incorrect estimation of the effect of wind.

Errors in laying, however, may be to some extent absorbed or neutralized by the inaccuracy of the gun itself, that is to say by the slight variations in the performance of the gun, which even when fired several times exactly in the same direction and at the same elevation, cannot expect to land every shell precisely in the same spot.

A series of rounds fired in this way will form a "pattern" on the ground. The accuracy of the gun, apart from the laying of it, may be gauged by the size and shape of this pattern which, as is well known, is almost always oval or elliptical in shape, the greatest diameter being along the line of fire.

This may be 100 or 200 yards in length or even more, according to the type of gun, but the least diameter at right angles to this is very much smaller and may not be more than twenty yards.

It is clear, therefore, that the permissible limits in laying for range are much greater than those in laying for line, and that an error of five minutes in the latter may shift the pattern right off the target.

It is unfortunate that it is rather more difficult to measure angles accurately from a map than linear distances. It is easy to scale off a range from a map to within twenty to thirty yards, to measure an

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angle correctly to five minutes is rather difficult. Even with the help of an artillery board it was still found necessary to correct the laying by observing the fall of the first few rounds.

Each battery, in fact, habitually "registered" as soon as possible after coming into a new position to verify the angle between its aiming point and a selected "datum" or ranging point in the vicinity of its targets.

The disadvantages of this are self-evident. Time and ammunition are expended in the process, and it is impossible to concentrate large bodies of artillery in one sector without the enemy becoming aware of it through the increased amount of "registration" fire.

The system received its final condemnation in the great Passchendaele offensive. It became necessary to lay out the initial "line" of a gun in a more accurate way. To do this the surveyor was again called in. Instead of the gunner measuring the angle at the gun between target and aiming point from the map, this was calculated and laid out by a surveyor on the ground at the gun itself.

The new method received its first trial at the "Tank" battle of Cambrai in October, 1917. For this attack none of the guns brought up to reinforce the line registered at all. Every heavy piece, and some of the lighter natures, was given its "line" by survey officers of the Third Army and opened fire for the first time at zero hour.

The result, as is well known, was not only a highly successful bombardment, but a complete surprise for the enemy—a complete and final vindication of the method. Steps were at once taken to extend and simplify its application, and it was used on many subsequent occasions; notably for the attack on Hamel by the Australians on 4th July, 1918, for Lord Rawlinson's great attack on 8th August, and for the attack of the Second Army at Ypres on 28th September.

On each occasion, though there was no preliminary registration at all, the bombardment was thoroughly effective, besides coming to the enemy as a complete surprise.

It must be admitted now that "registration" is "dead" if not buried, and that survey must be an integral part of gunnery. The gunner must know exactly how far his gun shoots at any and every elevation, and under all conditions of wind and temperature, and must be able to lay it exactly in any required direction. With the former the surveyor as such has little concern, it is a question of ballistics, but the latter is a purely survey problem soluble by any trained surveyor with the aid of those deadly weapons—a theodolite and a book of logarithm tables.

During the war all the duties described above were carried out by the Royal Engineers. In view, however, of the close connection between survey work and gunnery, it is obviously desirable that many of them should be performed by the artillery themselves.

It has been decided accordingly that in the future, location of targets by flash spotting and sound ranging, as well as the survey work required for shooting, will be done by the Royal Regiment, while the "triangulation" on which ultimately all survey work depends, and the preparation of maps, will remain as heretofore the duty of the Royal Engineers.

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From the point of view of numbers employed the bulk of the organization will thus pass to the Royal Artillery, at any rate for the present. For the future, who can tell? Right up to the end of the war the demands on the surveyor were still increasing, both in volume and variety. That he has not yet reached the limits of his rôle is certain.

The demand for maps alone was steadily and rapidly mounting. The increase may be gauged from the following figures :—

	Sheets.
Maps issued to the original B.E.F. (including strategical small scale as well as tactical maps)	335,000
Total number of maps issued to the troops in France and Belgium (chiefly tactical maps on large scales)	31,000,000
Maps printed and issued by one Field Survey Company in July, 1916 (Somme Battle) ...	5,000
Maps printed and issued by the same Field Survey Company in September, 1918	432,000

At the end of the war the average *daily* issue of maps to the B.E.F. was somewhere round about 50,000 sheets, representing some seven tons of paper.

Nor did this represent the total numbers, for large numbers of small maps were issued by Corps Topographical Sections which have not been counted in the above.

The accurate map is, in fact, tending more and more to replace the "personal reconnaissance" of the past, which is becoming increasingly difficult as the range and power of weapons and the extent of battlefields increases.

Nor can we say that the next war will not bring forth, as this one has done, altogether new developments and applications for survey methods.

The difficult problem of co-operation between the various arms in battle is, after all, largely a matter of letting "the other arm" know where you are and where the enemy is—the old problem of mutual directions and distances, for which the surveyor, who has other weapons in his armoury besides his theodolite and his book of log tables, can probably find a solution.

Wireless telegraphy is solving the problem of intercommunication, perhaps the surveyor can help to supply something useful to communicate, and prove as useful in the future to the foot-slogger or the cavalryman as he has been in the past to the gunner.

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THE PROMOTION OF ROYAL ARTILLERY OFFICERS.

A Suggestion.

BY CAPT. R. D. TUOHY, R.G.A.

"OFFICERS are anxious about their prospects. I do not think that they need be, the upper ranks are clearing fast, etc."

The above is a quotation from the Leaflet of recent date.

There are some Officers in the Regiment however, who may be excused for feeling discouraged about their prospects, among them the Senior Captains of the Royal Garrison Artillery, whose contemporaries in the Royal Horse and Royal Field Artillery have been substantive Majors for periods varying from 4 years and 7 months to 2 years and 5 months, at the present date; the Senior Captain of the Royal Garrison Artillery having 16 years and 7 months service and the junior Major of the Royal Horse and Royal Field Artillery having 5 years less service.

These Officers have been suffering also from that sickness of heart caused by deferred hope; firstly that the Amalgamation of the Regiment would restore to them their lost seniority, and secondly that the four years rule for Lieutenant-Colonels would cause them to be promoted before the end of 1921.

It is now understood that financial considerations have put an end to these hopes, and that there is no chance of any promotion from Captain to Major in the Royal Garrison Artillery for about 5 years.

This is a severe blow to the Officers concerned, who will thus become many years junior, not only to their contemporaries in the Regiment, but also throughout the Army.

In these circumstances a suggestion is put forward for which the following advantages are claimed.

1. *It entails no extra expenditure now and only the remote possibility of any in the future.*

2. Officers need not be moved from their present stations.

3. It obviates the humiliating necessity of officers passing a promotion examination to a rank which the majority of them have held for considerable periods under the supreme test of war, and which many officers of the Royal Horse and Royal Field Artillery (in many cases with far less total service) have attained from 2 to 4 years ago without any examination.

4. It will go far to alleviate the feeling of uneasiness which oppress many of the Officers concerned regarding their futures.

5. It will be possible to Amalgamate the Regiment, if so desired, without injustice to anyone concerned when all supernumerary officers are absorbed in the establishments.

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The course suggested is an unusual one, but it is submitted that the circumstances which it is designed to fit are unusual also, and that such difficulties as it presents are not insuperable.

A. The rank and seniority of all officers in the Regiment to be determined on the basis of the date of their first commission. In addition to the antedating of many officers in their present ranks, this involves the promotion and antedating of

78 Majors R.G.A. to Lieutenant-Colonel.
84 Captains R.G.A. to Major.
134 Lieutenants R.H. & R.F.A. to Captain.

(These figures are taken from the Blue List of January 1921, and are not accurate at the present date, being on the large side).

B. *Officers so promoted to remain in their present employments and to receive the Pay and Allowances of their present ranks only, until such time as they are absorbed in the establishments in the ordinary way.*

C. Such antedating or promotion to carry no back pay or allowances, or to entitle any officer so antedated to any increase of pay at an earlier date than he would receive if under present conditions.

D. The increase of pay granted to Captains with 15 years service to be granted to unpaid Majors when they reach 15 years service.

E. *Should any Officer so antedated or promoted be compulsorily retired for any cause outside his own control, such officer to receive the pension to which he would be entitled had he been promoted in the ordinary way.*

F. If it is desired to Amalgamate the Regiment eventually, all Officers joining in the future to be gazetted to the Royal Artillery.

The above is only a compromise, but it is observed that very many important questions are settled by a compromise nowadays, and as this matter is of supreme importance to many of the officers concerned, it is hoped that, these suggestions may receive sympathetic consideration.

The 13 years rule for promotion to Captain forms a precedent for promoting officers for whom there is no room on the establishment, and it is understood that in the Royal Marines, before the war, Captains were promoted brevet major under the same conditions.

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INTERMEDIATE HOWITZER CHARGES.

Alternative combinations as a solution to crest clearing problems.

BY CAPT. W. C. HOLDEN, D.S.O., M.C., R.G.A.

ONE of the leading considerations in the design of cartridges for light, medium and heavy howitzers, appear to be that the charges should be of such a size and number as to allow the whole of the zone of the gun to be reached without the necessity of giving a less elevation than 18° or 20° (with the exception of the extremely short ranges which can of course only be obtained with the lowest charge with less than 20° elevation).

For example, with the 4·5″ Howitzer under normal conditions a target at 5,150 yds. range may be considered the limit of the IV charge zone, necessitating an elevation of 40° or thereabouts, and a target at 5,200 yds. can only be attacked with V charge at an elevation of 20° 6′.

The advantage of limiting the minimum angle of elevation to 20° and not to—say—30°, is to reduce the number of charges required to 4 or 5. The greater we make our minimum angle, the more charges we require.

This particular angle, 20° or (allowing for abnormal conditions and ranging brackets) 17°, is one of the deciding factors in selecting any howitzer position, as no position can be occupied which has a near crest of more than 17° without encountering certain ranges at which the gun cannot fire.

In country such as the North of France, the finding of battery positions with ample crest clearance for howitzers was a very simple matter; as slopes of 20° were few and far between. The charges for which range tables are supplied will be sufficient to meet all cases.

In hilly and mountainous country such as the Balkans, Asia Minor and other parts of the middle East, the problem of clearing the crest assumes a much more formidable aspect.

The Macedonian front during the recent war will serve as a very good example. The country is very mountainous, consisting of hills rising from ravines to heights of 800 or 1,000 feet. The sides of the hills are nearly always convex, getting steeper and steeper downwards and ending in slopes of 25° or vertical escarpments. Practically all the roads have to follow these ravines and all heavy wheeled transport is confined to these roads. At first sight the country seems to abound with ideal howitzer positions, but it is only with the greatest care and difficulty that positions can be found which are in any way get-at-able and giving the necessary flash cover and an angle of clearance with the Range Table charges.

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It is no exaggeration to say that increasing the minimum crest angle to 25° doubles the number of potential battery positions in mountainous country.

There were portions of the Macedonian front on which it was impossible to find a position for an 8″ howitzer which would allow all ranges to be reached with the help of the Range Table charges alone. An intermediate charge between charge III and charge IV was absolutely necessary.

Fortunately such a difficulty can be overcome without resorting to making up bags of cordite of the necessary weight. In all our light, medium and heavy howitzers the charges are made up of 3, 4, or 5 portions, of different weights. For example, 6″ Howitzer N.C.T. size 16 :—

Core		=	$35\frac{3}{4}$ ozs.
Part	2	=	$16\frac{3}{4}$ ozs.
Part	3	=	$13\frac{1}{2}$ ozs.
Part	4	=	26
Total		=	92 ozs.

The ordinary R.T. charges are made up as follows :—

Core	charge	1	=	$35\frac{3}{4}$ ozs.
Core & Pt. 2	,,	2	=	$52\frac{1}{2}$ ozs.
Core Pts. 2 & 3	,,	3	=	66 ozs.
Core Pts. 2, 3, & 4	,,	4	=	92 ozs.

The essential part which has to be included in any charge is the Core, which carries the igniter. To obtain a charge somewhere between III and IV all that is necessary is to remove part 3 from the full charge, which will leave the core with parts 2 and 4, having a total weight of $78\frac{1}{2}$ ozs.

A cartridge composed of four parts of different weights will allow combinations giving 8 different charges, and a cartridge of 5 parts, 16 such charges.

Prepare a table from the Standard Range Table as follows :—

TO CONSTRUCT A RANGE TABLE FOR A NEW CHARGE.

6-inch Howitzer.

Elevation.	Chg. I.	Chg. II.	Chg. III.	Chg. IV.	Super.
10°	1813	2658	3315	4233	
15°	2560	3716	4577	5727	
20°	3192	4614	5636	6974	
25°	3698	5334	6485	7970	
30°	4087	5863	7119	8742	9161
35°	4360	6237	7540	9280	9612
44° 36′	4468	6433	7787	9682	10018

(1) The figures in column 1 are selected elevations and the remaining columns are the ranges reached with the Range Table charges at the selected elevations.

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(2) **By means of a table prepare a graph (Fig. 1). The horizontal** line represents ozs. in weight of charge.

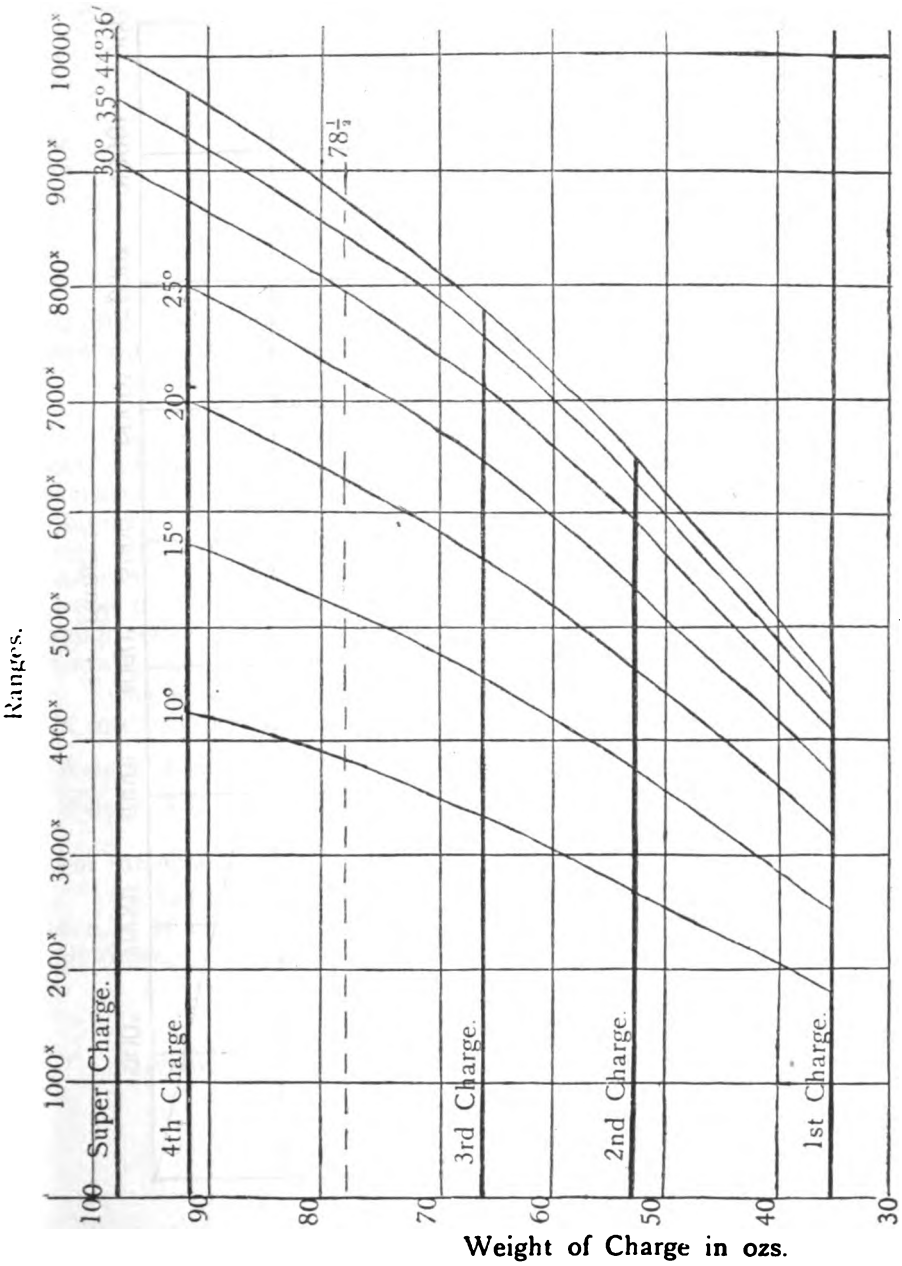

Fig. 1.

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Against the weight of each charge plot the ranges reached with each selected angle of elevation. Draw out the curves as in Fig. 1.

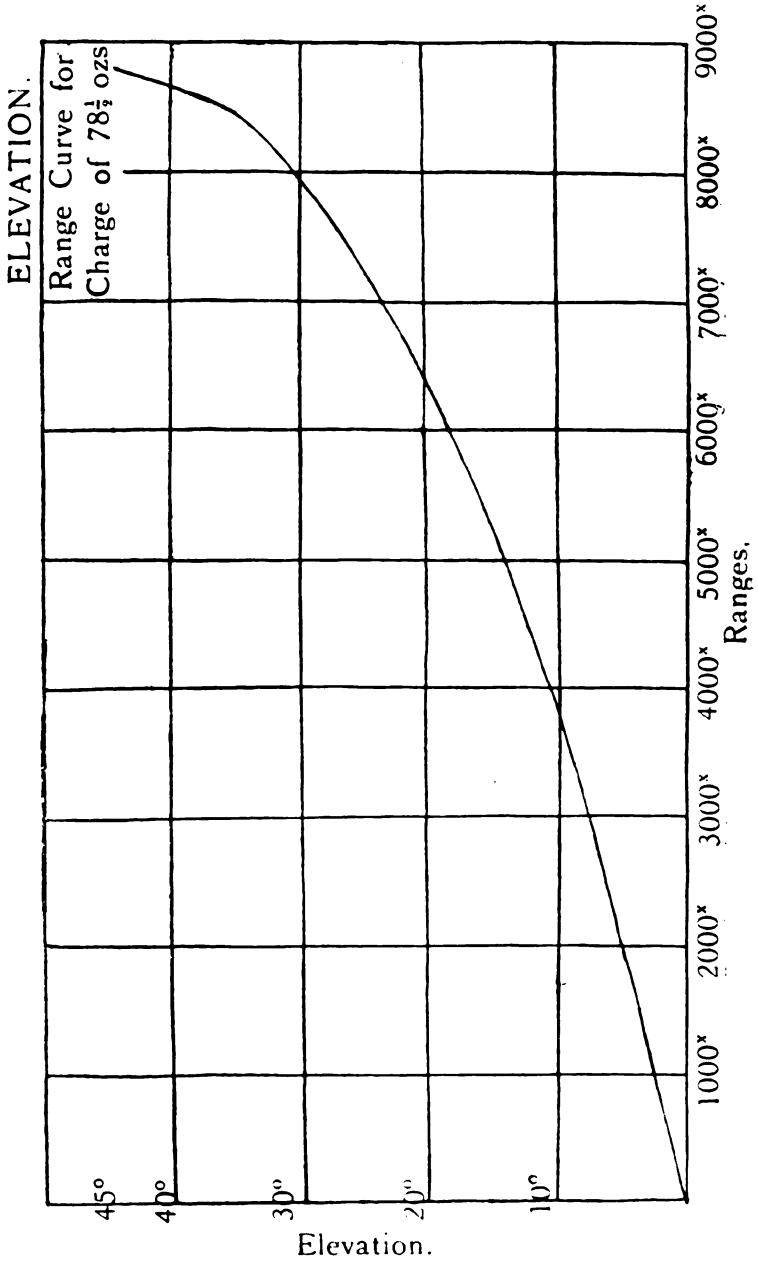

FIG. 2.

Each curve now represents the ranges reached by various weights of charges at a certain elevation. By drawing a horizontal line through

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the weight of the charge for which it is desired to construct a range table, the ranges for 10°, 15°, 20°, 25°, 35°, 44° 44° 36′ elevation for that charge can be read off immediately. In the example shown, a charge of 78½ ozs., 6″ Howitzer, the figures are :—

Elevation.	Range.
10°	3820
15°	5200
20°	6370
25°	7280
30°	7950
35°	8490
44°36	8800

A graph is then made (Fig. 2) plotting angles of elevation against ranges, and from this the range and elevation columns of the new range table are prepared.

VARIATIONS.

In order to complete the range table it will be necessary to work out suitable correction columns. The figures can be obtained with considerable labour by the methods laid down in the Text Book of Gunnery, Part I, but as this volume is not usually obtainable on service, an interpolation method has to be resorted to, which in fact is, sufficiently accurate for all practical purposes. The method which seems most suitable is to interpolate for the new charge between the range table charges next above and below at various angles of elevation.

The calculations can be made less tedious by the use of a factor in interpolating such as—

$$\frac{\text{Weight of new charge } \textit{minus} \text{ weight of lower Range Table charge}}{\text{Weight of higher Range Table charge } \textit{minus} \text{ weight of lower Range Table charge}}$$

For example :—

To find the value of 1″ variation in Barometer and 10 f.s. Variation of M.V. at 8000 yards with a charge of 78½ ozs. N.C.T. 6″ Howitzer.

$$\text{Factor } \frac{78\tfrac{1}{2} - 66}{92 - 66} = \cdot 48$$

Elevation for 8000ˣ = 30° 10′ (78½ oz. chg.)

1″ Bar at 30° 10′ charge III = 40ˣ
1″ Bar at 30° 10′ charge IV = 72ˣ

Diff = 32ˣ

Diff × factor = 32ˣ × ·48 = 15ˣ

∴ 1″ Bar at 8000ˣ with 78½ oz. charge = 40 + 15 = 55ˣ

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10 f.s. at 30° 10′ charge III = 92ˣ
10 f.s. at 30° 10′ charge IV = 67ˣ

Diff = 25ˣ

Diff × factor = 25ˣ × ·48 = 12ˣ.

∴ 10 f.s M.V. at 8000ˣ with 78½ oz. charge = 92 - 12 = 80ˣ

It will only be necessary to work out the values at selected ranges and the values at the remaining ranges can be inserted by direct interpolation or plotting.

MUZZLE VELOCITY.

The muzzle velocity given by any weight of charge may be obtained very simply from a graph made by plotting the weights of the Range Table charges against the M.Vs. given in the Range Table (Fig. 3).

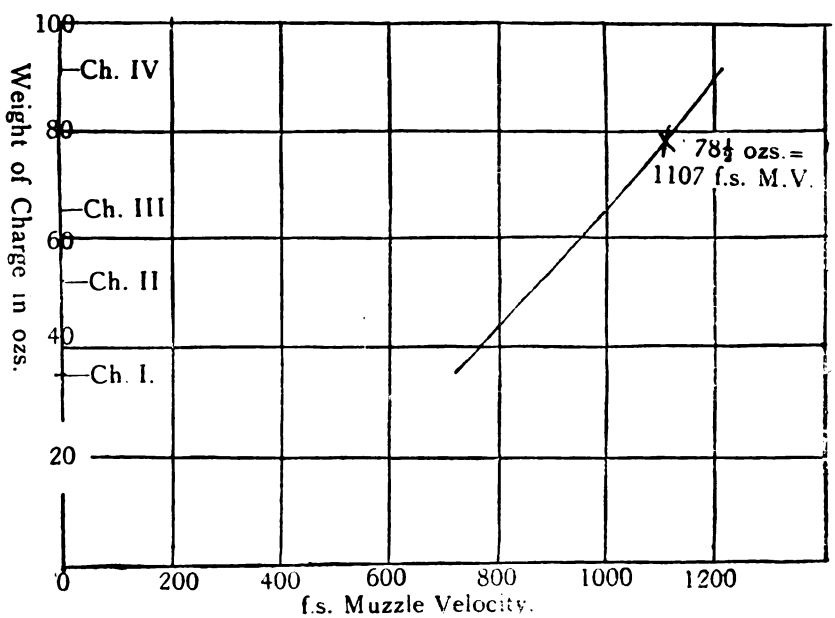

FIG. 3.

As a point of drill any such composite charge may be designated "charge one—two—four" meaning that the charge is composed of parts 1, 2 and 4 of the cartridge.

The above methods were found by the writer to give excellent results with the 8-inch Howitzer; but if we are to expect operations in mountainous countries, the provision of additional tables covering all possible combinations of charges appears desirable.

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

Journal of the U.S. Artillery.—June, 1921.

Tactical organisation and employment of searchlights against Naval targets. Maj. John S. Pratt.

The future of Anti-aircraft Artillery. R. V. Morse. (Morse Instrument Co.) (A reply to Anti-aircraft? see July Journal).

Belgium.

Bulletin belge des Sciences Militaires.—July, 1921.

I. Gas warfare. (Continued.) Dr. de Sillevaerts.

II. The effect of the War on Artillery. (A lecture by Gen. Pontus, continued.)

III. Notes on Armoured Car. Continued. Cap. Comdt. Vanderdonert.

IV. "Caterpillars"—Infantry—Artillery—Cavalry.

An interesting article. The author commences by saying that the allied victory was greatly helped by the use of Tanks in large numbers.

It must not, however, be supposed that Tanks will be of the same value in future wars.

Like Gas, Tanks no longer possess the element of Surprise.

In 1918 they were all powerful. The English and French had at their disposal a new weapon against which the Germans had not had time to develop a defence.

If the war had lasted, doubtless Anti-Tank defence would have rendered Tanks if not useless, nearly so.

He quotes the casualties to Tanks in August 1918. Out of 688 tanks used on 8.9.10.11 August, 480 were sent back for overhaul. Very few amongst those remaining were fit for a long action.

His conclusion is that the 'caterpillars' that will be most important in the future are the 'gun-carrying tank', supply tank, and the tractor.

The Infantry requirements will be—

I. The accompanying gun—

(1) Must be able to move on wheels, as well as being a track-laying vehicle. The time taken in changing from wheel to track must be short. (The Americans have a machine of this sort taking 15 minutes to change either way).
Speed off the roads 8—10 kilos.

(2). Must not be too visible or vulnerable. Therefore not too big. A 105 or 120 howitzer is big enough for the gun. As the range need not exceed 2,500 metres, the gun might be shortened. The car to carry this and two men need not be too big.

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One can only hope to be splinter and bullet proof—to attempt more would add to the weight.
Positions within 1000 of leading infantry should be easy to take up owing to speed of the car.

(3). Getting into action must be quick. If infantry bump into machine gun nests the gun should be able to knock them out in a few minutes.

(4). 10 hours petrol should be carried.

(5). 40 rounds should be carried and two ammunition tanks each carrying 100 rounds to each gun.
4 guns—8 ammunition tanks per Infantry Regiment.
This battery an Infantry Unit under the Regimental Commander.

II. Transport caterpillar.

III. Ammunition and ration supply caterpillar.

The Caterpillar and the Cavalry.

The author does not propose discussing if the 'tank' can *replace* cavalry—only how it can *help* cavalry.

I. Cavalry accompanying tanks—much on same lines as Infantry gun-carrying tank only lighter—carrying a 75$^{m/m}$ gun shortened, and machine guns.
Each cavalry regiment to have a battery consisting of two sections.
Each section comprises—
1 gun tank with 30 rounds and 5 men.
1 Ammunition tank with 150 rounds.
2 Machine gun tanks.

The author advocates keeping the Horse Artillery entirely horse drawn.

In what he says re the Artillery caterpillar he is evidently not too keen in taking away the Field and Medium Artillery Horses.

V. Musketry Instruction.

VI. Notes on foreign Armies, etc.

France.

Revue Militaire Générale.—May—June, 1921.

I. The Military Intelligence Service under Napoleon I. J.R.

II. Comparison of Infantry Fire Tactics before and after the war 1914—1918. Capt. Laffargue.

III. The great German Offensive (from the diary of a Cavalry Officer. Maj. de Cossé Brissac.

IV. Development of Field Fortification in the late war. Capt. Botte.

V. The Railway Control Committee. Maj. Raoult.

Revue d'Artillerie.—June, 1921.

I. Different ways of assessing wages. Their influence on Cost Price. Maj. Graux.

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II. Fire Tactics. Chapter III. Col. E. Cambuzat.
III. The defences of Heligoland. Maj. Armstrong, (American Army).
IV. Improvement in mobility of heavy Artillery. Capt. Maisons.
V. "Caterpillars." Chaps. I. II.
VI. Battery Administration in War. Lt. Ruffet.
VII. Development of Artillery methods of Fire during the war. A. England. B. Belgium. C. Italy. (See also *Revue d'Artillery*—March 1920, p. 160 for German methods of Fire).
VIII. Miscellaneous Notes. The 42c/m Howitzer with illustration.

Switzerland.

Revue Militaire Suisse.—June 1921.

I. An infantry Captain's rôle during the war. Capt. Glasson.
II. On the psychology of war.
III. French and American News.

Spain.

Memorial de Artilleria.—June, 1921.

The defences of Heligoland.

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GIFTS AND PURCHASES DURING THE MONTHS OF JUNE AND JULY, 1921.

Books Presented.

By The Secretary, War Office.

"Staff College Regulations (Camberley) 1921."

"Report on the Examination for Certificates "A" & "B" held in March, 1921 for Cadets of the Senior and Junior Divisions, O.T.C."

By The Secretary, 355 Siege Battery, Old Comrades Association.

"The Record of the 355 Siege Battery." (Compiled and published under the auspices of the 355 Siege Battery, O.C.A.).

By The Secretary, Institution of Civil Engineers.

"Minutes of Proceedings of the Institution of Civil Engineers. Vol. 208, 1921."

By The Hon. Secretary, Royal Society of Canada.

"Proceedings and Transactions of the Royal Society of Canada, 3rd Series, Vol. XIV. 1920."

By The Under Secretary of State for India.

"The India Office List, 1921."

Books Purchased.

"Les Chars d'Assaut. Leur Creation et leur Role pendant la Guerre, 1915-18." Par Capitaine Dutil. Paris (Berger-Levrault) 1919.

"The Fifth Division in the Great War." By Brig.-Genl .A. H. Hussey and Major D. S. Inman. London (Nisbet) 1921.

"The Official Names of the Battles, and other Engagements, fought by the Military Forces of the British Empire during the Great War, 1914-19, and the Third Afghan War, 1919." London (Stationery Office) 1921.

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REGIMENTAL LIST. The following Postings have occurred during the period 16th June, to 15th July, 1921.

Postings.—R.H. and R.F.A.

Aikenhead, Capt. D. F., M.C., from 19th Bde. Egypt, to 17th B.A.C. 28/6/21.
Ashe, Lieut. V. C., from 94th Batty, to 93rd Batty. 28/6/21.
Athill, Maj. L. F. I., from att. IV. Res. Bde., to att. 16th Bde. 22/6/21.
Barraclough, Lieut. A. J., D.C.M., from att. IV. Res. Bde., to II. Res. Bde. 23/6/21.
Block, Maj. A., from att. 9th Bde., to 20th Batty. 18/6/21.
Bush, Lieut. R. F. L., from att. 19th Bde. to 19th B.A.C. 7/7/21.
Bushe, Lieut. R. F. L., from 16th Bde., to 19th Bde. 16/6/21.
Butler, Lieut. A. E., from Staff, to 84th Batty. 11/6/21.
Campbell, Capt. J. O., D.S.O., M.C., from 16th Bde. to 19th Bde. 16/6/21.
Campbell, Capt. J. O., D.S.O., M.C., from att. 19th Bde. to 39th Batty. 7/7/21.
Dangar, Lieut. H. V., from "J" Bty. R.H.A., to "J" Ammn. Col. 1/4/21.
Durie, Maj. T. E., D.S.O., from 16th Bde., to 19th Bde. 16/6/21.
Durie, Major T. E., D.S.O., M.C.., from att. 19th Bde. to 39th Batty. 7/7/21.
Esmonde-White, Maj. J., from V. Res. Bde., to att. 15th Bde. 18/6/21.
Fennell, Lieut. W. J., from "D" Ammn. Col., to "D" Batty. R.H.A. 1/4/21.
Fowler, Lieut. B. J., M.C., from "J" Ammn. Col., to "J" Batty. R.H.A. 1/4/21.
Goschen, Lt.-Col. A. A., D.S.O., from att. 5th Bde. R.H.A., to 5th Bde. R.H.A. 24/6/21.
Grant, Capt. P. F., from 16th Bde., to 19th Bde. 16/6/21.
Grant, Capt. P. F., from att. 19th Bde. to 97th Batty. 7/7/21.
Hammond, Lieut. H. B., from att. 17th Bde. to 10th Batty. 23/6/21.
Hancocks, Capt. A. C., M.C., from 16th Bde., to 19th Bde. 16/6/21.
Hancocks, Capt. A. C., from att. 19th Bde. to 131st Batty. 7/7/21.
Harvey, Lieut. H. B., from 135th Batty., to 132nd Batty. 7/6/21.
Horsfield, Lieut. G., from 23rd Bde., to 4th D.A.C. 21/6/21.
Jarvis, Lieut. D. P., from 16th Bde., to 19th Bde. 16/6/21.
Jarvis, Lieut. D. P., from att. 19th Bde. to 19th B.A.C. 7/7/21.
Jephson, Lieut. E. W. F., M.C., from "F" Batty, R.H.A. to att. "N" Batty. 2/7/21.
Jones, Lieut. A. V. D., from 132nd Batty., to 135th Batty. 7/6/21.
Joyce, Major L. W., from 4 Depot, R.F.A. to Commdg. 58th (H.C.) Bde. T.F. 13/7/21. Tempy.
Kendall, Lieut. C. E., from att. 19th Bde. to 96th Batty. 7/7/21.
Leech, Maj. (Bt. Lt.-Col.) A. G., D.S.O., from IV. Res. Bde., to 48th Batty. 29/6/21.
Le Maistre, Lieut. G. A., from IV. Res. Bde., to VI. Res. Bde. 23/6/21.
Lewis, Lieut. W., from att. 19th Bde. to 131st Batty. 7/7/21.
Macdona, Maj. B. V., from 19th Bde., to 92nd Batty. 28/6/21.
Macdonald, Lieut. A. B., from 93rd Batty., to 94th Batty. 28/6/21.
Mills, Lieut. H., from att. 19th Bde. to 19th B.A.C. 7/7/21.
Minson, Lieut. A. J., M.C., from 96th Batty. to H.Qrs. 19th Bde. 7/7/21.
Morley, Lieut. R., M.C., from 16th Bde., to 19th Bde. 16/6/21.
Morley, Lieut. R., M.C., from att.. 19th Bde. to 39th Batty. 7/7/21.
Neve, Capt. R. B., from 16th Bde., to 19th Bde. 16/6/21.
Neve, Capt. R. B., from att. 19th Bde. to 19th B.A.C. 7/7/21.
Neville, Lieut. C., M.C., from "D" Batty. R.H.A., to "D" Ammn. Col. 1/4/21.
Ormsby, Lieut. J. Y., from 96th Batty. to 39th Batty. 7/7/21.
Paris, Lieut. D. K., M.C., from 94th Batty., to 95th Batty. 28/6/21.
Paton-Walsh, Lieut. E. J., from 59th Batty., to 95th Batty. 28/6/21.
Philipson, Capt. J. T., from 19th Bde., to 17th Bde. 28/6/21.
Phillips, Lieut. H. C., from V. Res. Bde., to 1st Bde. 23/6/21.
Popham, Maj. G. L., D.S.O., from R.F.A. India, to 4th D.A.C. 22/6/21.
Potter, Lt.-Col. C. F., C.M.G., D.S.O., from D.A.A. & Q.M.G. Scottish Command to 3rd Bde. R.F.A. Rhine. On Promn. 13/7/21.
Rowe-Evans, Lieut. C. B., from 19th B.A.C. to 97th Batty. 7/7/21.
Rowell, Lieut. G. L. S., from att. Remounts to 96th Batty. 7/7/21.
Stewart-Cox, Capt. A. from unposted, to att. IV. Res. Bde. 20/6/21.
Turner, Lieut. C. G. N., from 59th Batty., to 93rd Batty. 29/6/21.
Valle-Pope, Lieut. E. L., from H.Qrs. 4th Bde. to H.Qrs. 84th Bde. 2/7/21.
Wilson, Maj. D. C., D.S.O., from unposted, to att. III. Res. Bde. 4/6/21.

Cancellation of Postings.

Rogers, Lieut. W. H. G., to R.E. Mounted Depôt. 6/6/21.
Whatton, Capt. S. M. de H., D.S.O., M.C., to Adjt., 21st Bde. R.F.A. 27/5/21.

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Postings.—Royal Garrison Artillery.

Adams, Maj. (Bt. Lt.-Col.) L. C., C.B.E., from Member Ordnance Committee, to att. H.Q. & D.E. Thames & Medway. 5/7/21.
Carr, Lieut. L. C., from 2 Depôt, to att. Irish Comd. 28/6/21.
Chandler, Lieut. H. R., from att. Irish Comd., to "O" Coast Batty. 28/6/21.
Christian, Maj. W. F., D.S.O., from Adjt. T.F., to Command, 12th (Carnarvon & Denbigh) Bde. R.G.A., T.F. 20/6/21.
Cream, Maj. R. T. C., M.C., from att. Irish Comd., to 19th Batty. 22/6/21.
Dawson, Lieut. E. G., from att. Irish Comd., to "G" Coast Batty. 28/6/21.
Denton, Lieut. R. M. V., from att. Irish Comd., to II. Res. Bde. 28/6/21.
Dickson, Major J. Mc A., from Bermuda, to att. Irish Comd. 30/6/21.
Dimmock, Lieut. H. P. D., from att. 18th Batty. to 18th Batty. 5/7/21.
Ede, Lieut. A. J., from "N" Coast Batty., to att. Irish Comd. 28/6/21.
Emptage, Lieut. E. E., from "P" Coast Batty., to att. Irish Comd. 28/6/21.
Evans, Lieut. W. O'C., from Gibraltar, to Malta. 16/6/21.
Fayrer, Lieut. W. C. J., from II. Res. Bde., to att. Irish Comd. 28/6/21.
Ferguson, Maj. K. B., from "N" Coast Batty., to Mauritius. 16/6/21.
Firth, Lieut. J. E. A., from att. Irish Comd., to "N" Coast Batty. 28/6/21.
Fleetwood, Lieut. G. F., from "G" Coast Batty., to att. Irish Comd. 28/6/21.
Flood, Lieut. F. W., from att. Irish Comd., to "K" Coast Batty. 28/6/21.
Foulger, Lieut. F., D.C.M., from I. Res. Bde., to att. Irish Comd. 28/6/21.
Gaitskell, Capt. (Bt. Maj.) H. W., O.B.E., from unposted to att. 10th Bde. for G.S. course. 1/7/21.
Gale, Maj. H. J. G., D.S.O., from 47th Pack Batty., to 38th Pack Batty. 30/5/21.
Garrett, Maj. R. C., from 2 Depôt, to 3 Depôt. 22/6/21.
Glennie, Lieut. J. F., from att. Irish Comd., to 7th Bde. 27/5/21.
Goble, Lieut. (Qr.-Mr.) W. R., from W.O. Class 1. 34th Bde. to South Irish Coast Defences on promotion. 7/7/21.
Goldney, Capt. R. M., from att. Irish Comd., to Portsmouth. 28/6/21.
Goldsmith, Lieut. G. R., from att. Irish Comd., to "M" Coast Batty. 28/6/21.
Goldsmith, Lieut. S. J., from att. Irish Comd., to "F" Coast Batty. 28/6/21.
Grant, Lieut. J. L., from "O" Coast Batty., to att. Irish Comd. 28/6/21.
Grundy, Lieut. J., M.B.E., M.C., from att. Irish Comd., to "I" Coast Batty. 28/6/21.
Harvey, Maj. W. K., from Headquarters, Irish Comd., to South Irish Coast Defences. 5/7/21.
Hyde, Lieut. (D.O.) H. T., from Dover, to 4 Depôt. 30/6/21.
Jackson, Lieut. L. H., from II. Res. Bde., to att. Irish Comd. 28/6/21.
Jutilane, Lieut. J., from 8th Bde., to att. Irish Comd. 28/6/21.
Keogh, Lt.-Col. J. H., from 4th P.A. Brigade to P. A. Depôt. 6/7/21.
Kestin, Lieut. C. A., from 47th Pack Batty., to 11th Pack Bde. 30/5/21.
Lawn, Lieut. E. J., from "E" Coast Batty., to att. Irish Comd. 28/6/21.
Lecky, Maj. M. D., D.S.O., from I. Depôt, to II. Res. Bde. 22/6/21.
Luker-Brown, Lieut. W. G. A., from "F" Coast Batty., to att. Irish Comd. 28/6/21.
Maffett, Lieut. W. V. C., from 8th Bde., to att. Irish Comd. 28/6/21.
Maitland-Addison, Major (Bt. Lt.-Col.) J. F. R. N., from Artillery College, Woolwich, to H.Q. and D.E., Thames and Medway. 8/7/21.
Malcolmson, Lieut. K. G., from att. Irish Comd., to 5th Bde. 18/6/21.
Maskell, Lieut. E. C. W., from att. Irish Comd., to 10th Bde. 28/6/21.
Mercer, 2nd Lt. L. W., from 8th Bde., to 35th Batty. 7/7/21.
Millar, Lieut. P. P., from att. Irish Comd., to I. Res. Res. Bde. 28/6/21.
Milman, Major O. R. E., D.S.O., from H.Q. & D.E. Milford Haven, to "O" Coast Batty., Milford Haven. 5/7/21.
Mitchell, Lieut. G. W., from 47th P.A. Batty., to 8th Batty. 7/7/21.
Moore, Lieut. F. V., from att. Irish Comd., to "O" Coast Batty. 28/6/21.
Newton, Capt. P. I., D.S.O., from attached 2nd Pack Arty Bde. to attached 4th Bde. for G.S. Course. 1/7/21.
Nunn, Lieut. W. V., from 8th Bde., to att. Irish Comd. 28/6/21.
Peiniger, Major R. F., from Staff to Unposted List. 28/4/21.
Robinson, Lieut. H., from 10th Bde., to att. Irish Comd. 28/6/21.
Ross, Lieut. J. G. S., from 15th Batty., to 16th Batty. 5/7/21.
Sanders, Lt.-Col. W. O. S., D.S.O., from Major I.G., Hong Kong,, to Comdg. R.G.A., Hong Kong. On promotion. 13/7/21.
Slade, Lieut. F. R., from Attd Irish Command to "L" Coast Battery, Dover. 1/7/21.
Springfield, Capt. C. H. D. O., from "A" Coast Batty., to att. II. Res. Bde. 17/6/21.
Stoddart, Lieut. E., from 2 Depôt R.G.A., to att. Irish Comd. 28/6/21.
Suddick, Lieut. R. H., from "L" Coast Bty., to att. Irish Comd. 28/6/21.
Vivian, Lieut. J. A., from 1st Pack Arty Bde, Bulford to Attd G.H.Q. Ireland. 1/7/21.
Walker, Lieut. F. McF. from att. R.A.O.C., to att. 1st Pack Arty. Bde. 18/6/21.

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Staff Appointments.

Royal Artillery.

Cooper. Lieut. (D.O.) J. N., Asst. to C.I. Woolwich Arsenal. 18/6/21.
Hinde, Col. A., C.M.G., from G.S.O. 1st Grade (temp.) to Silesia. 7/6/21.
Martelli, Col. H. de C., D.S.O., to A.Q. M.G., Eastern Command. 24/6/21.

Royal Horse and Royal Field Artillery.

Bell, Lieut. J. G., Seconded to Indian Ordnance Department. 17/6/21.
Body, Capt. O. G., D.S.O., Adjt. & Qr.-Mr. Arty. School, Quetta. 17/3/21.
Calvert-Jones, Lieut. P. G., M.C., Instructor, Arty. School, Quetta. 13/3/21.
Coghill, Lieut. M. P. N. S., from Special Appointment to G.H.Q., Constantinople, 28/5/21.
Curzon-Howe, Lieut. A. P., A.-D.-C. to G.O.C. 1st Divn. (temp). 13/6/21.
Cotter, Capt. R. K., M.C., Seconded to Indian Ordnance Department. 24/6/21.
Digby, Lieut. H. A., attached to R.A.O.C. 17/6/21.
Gage, Lieut. E. H., M.C., Extra A.D.C. to G.O.C. in C. Aldershot Command. 1/6/21.
Jackson, Capt. C. R., M.C., Attached Tank Corps. 10/7/21.
Rawlins, Lieut. S. B., M.C., to King's African Rifles. 4/7/21.
Rayson, Lieut. J. H. K., Staff Lieut. A.G. 10, War Office. 1/6/21.
Taylor, Lieut. A. St. L., attached Officer, A.G. 10, War Office. 27/6/21.
Tomlin, Lieut. S. C., Control Post Officer, Rhine. 20/5/21.
Walker, Lieut. E., M.M., to Attached Royal Engineers, Porton. 5/7/21.

Royal Garrison Artillery.

Ashley, Capt. J. O. M., appointed G.S.O., 3rd Grade, M.I.4, War Office. 25/6/21.
Barron, Maj. (Bt. Lt.-Col.) F. W., O.B.E., G.S.O., 1st Grade, W.O. 6/1/21.
Bartholomew, Lieut. P. A., Experimental Officer (on probn.). 18/6/21.
Brown, Lieut. P. W. F., Intelligence Officer, 6th Div. 5/5/21.
Chidson, Capt. M. R., M.B.E., Attached Officer M.I.3, War Office. 1/7/21.
Cummins, Capt. A. A., to Asst. Inspector, Inspection Staff. 16/7/21.
Gee, Lieut. E. E., Capt. I.G., Severn Coast Defences. 17/10/20.
Gulland, Capt. A. H., attached Officer, S.R. 1. (e), W.O. 15/6/21.
Hall, Capt. A. C. S., G.S.O., 3rd Grade, 6th Division. 13/6/21.
Hordern, Capt. H. M., M.C., to Attached Tank Corps. 4/7/21.
Hughes-Hallett, Capt. W. E., M.C., Instr., Artillery School, Quetta. 25/8/21.
Mears, Lieut. G. G., M.C., to be extra A.D.C. to His Excellency the Viceroy of India. 23/5/21.
Martin, Lieut. L. J., seconded to Indian Ordnance Department. 26/6/21.
Perrott, Lieut. R. O., Adjutant & I.G., Rangoon. 21/9/20.
Pratt, Maj. (Bt. Lt.-Col.) E. R., M.C., Commdt., Internment Camp, Curragh. 1/4/21.
Russell, Major (Bt. Lt.-Col.) A. G., M.C., to Attached Officer, A.G.6, War Office. 5/7/21.
Strover, Major M. R., to Special Appointment, Constantinople. 7/2/21.
Tennent, Capt. C. B., Seconded to Indian Ordnance Department. 17/6/21.
Thom, Major J. H., D.S.O., Commandant, Personnel, Arty. College. 18/6/21.

REGIMENTAL LIST. The following Casualties have taken place from 16th June, to 15th July, 1921.

Promotions. (Regimental).

Cox, Major C. H. F., D.S.O., to be Lieut.-Col., R.F.A. and to remain seconded 1/7/21.
Goble, Warrant Officer Class I, W. R., to be Lieut. & Quarter-master. 27/5/21.
Harvey, Major W. K., to be Lieut.-Col., R.G.A. 18/7/21.
Moore, Capt. (D.O.) W. J., to be Major (D.O.). 25/6/21.
Potter, Major (Bt. Lt.-Col.) C. F., C.M.G., D.S.O., to be Lieut.-Col., R.F.A. 1/7/21.
Stillwell, Major W. D., D.S.O., to be Lt.-Col. R.F.A., 24th June, 1921.

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Promotions.—*Continued.*

The undermentioned 2nd Lieuts to be Lieutenants:—

ROYAL HORSE AND ROYAL FIELD ARTILLERY.

Dated 5/6/21.

Carr-Harris, L. H.

Dated 17/7/21.

Hogan, H. T.
Rowbotham, G. R.
Higgs, W. H.
Norbury, H. G.
Thompson, J. H. C.
Renton, M. J.
Calver, J. W.
Aitken, L. G.
Powles, S. H.
Chapman, G. P.
Burne, J. R.
Spurrier, H. H.
Rooney, O. P. J.
Justice, F. L.
Taylor, R. H. R.
Williamson, J.
Woods, R. B.
Dalrymple, D.
Parker, F. J.
Robertson, I. G.
Cornwall, J. W.
Temple, W. T.
Brodie, E. F. S.
Potter, A. H. C.
Darling, J. L. A.

ROYAL GARRISON ARTILLERY.

Dated 17/7/21.

Lambooy, A. P.
Treays, W. H .
Truscott, H. B.
Duvivier, J. J. (To remain seconded).
Abinett, W. G.
Capell, B. A.
Hunt, C.
Morton, F. K. (To remain seconded).
Bartholomew, P. A.

Promotions. (Other than Regimental).

Christian, Major W. F., D.S.O., to be temp. Lt.-Col. T.F., 1st April, 1921.
Finlayson, Major R. G., C.M.G., D.S.O., to be Colonel, 22nd June, 1921. Seniority 3rd June, 1919.
Green, Colonel A. F. U., C.M.G., D.S.O., Temp. Colonel on the Staff. 22nd June, 1921.
Haynes, Lt.-Col. K. E., C.M.G., C.B.E., to be Colonel, 12th July, 1921, with seniority 29th Nov., 1919.
Hill, Lt.-Col. H. W., C.M.G., D.S.O., to be Colonel, 15th July, 1921, with seniority 22nd June, 1921.
Hinds, Lieut. G. H., to be temp. Capt. while employed as Class F.F., 1st Aug., 1920.
Kirby, Colonel A. D., C.B., C.M.G., to be temp. Col. Commdt., 2nd April, 1921.
Ogg, Colonel G. S., C.I.E., to be temp. Col. on the Staff, 1st Jan., 1921.
Rickard, Lt.-Col. F. M., to be Colonel, 15th July, 1921, with seniority, 3rd June, 1921.
Rowan-Robinson, Lt.-Col. H., C.M.G., D.S.O., to be Colonel, 15th July, 1921, with seniority, 1st May, 1921.
Turner, Lt.-Col. A. J., C.B., C.M.G., D.S.O., to be Colonel, 22nd June, 1921. Seniority, 3rd June, 1919.
Wilkinson, Lt.-Col. M. L., to be Colonel, 12th July, 1921, with seniority, 1st Jan., 1921.
Young, Col. H. A., C.I.E., C.B.E., to be temp. Colonel on the Staff, 1st Jan., 1921.

To Half Pay.

Clark, Lt.-Col. W. E., C.M.G., D.S.O., 24th June, 1921.
Hill, Lt.-Col. H. W., C.M.G., D.S.O., 22nd June, 1921 (retains present employment).
Nelson, Lieut. R. D. (temp.) on account of ill health, 24th June, 1921.

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To Temporary Half Pay.

Barker, Major C. H., temp. half-pay on account of ill-health, 28th May, 1921.
Carey, Lt.-Col. W. L. J., C.I.E., to retain appointment, 13th July, 1921.
Fraser, Col. L. D., C.B., C.M.G., 25th June, 1921.
Gethin, Lt.-Col. Sir R. W., St. L., Bart., C.M.G., D.S.O., to retain appointment, 1st July, 1921.
Gill, Lt.-Col. D. H., C.M.G., D.S.O., 9th July, 1921.
Loring, Lt.-Col. W., C.M.G., D.S.O., 13th July 1921.
Martelli, Colonel H. de C., D.S.O., from Staff, 12th June, 1921.
Phillips, Capt. A. H. D., on account of ill-health, retaining present employment, 5th Oct., 1919.
Rainsford-Hannay, Lt--Col. F., C.M.G., D.S.O., 1st July, 1921.
Walshe, Col. F. W. H., C.M.G., D.S.O., A-D-C. to the King, 10th March, 1921.

Transfer.

Ventris, Major E. F. V., to Indian Army. *L.G.*, 11th Jan., 1921.

Retirements on Retired Pay.

Aitken, Major N. W., D.S.O., M.C., 25th June, 1921.
Austin, Major (D.O.) T., 25th June, 1921.
Bethell, Col. A. B., C.M.G., D.S.O., from half-pay list, 1st July, 1921.
Blanford, Lt.-Col. W. G., from half-pay list, 12th July, 1921.
Brabazon, Lieut. J. P., 28th June, 1921.
Buzzard, Col. F. A., D.S.O., from half-pay list, 12th July, 1921.
Davies, Lieut. A. L., M.C., on account of ill-health, 27th Sept., 1919, with rank of Capt.
Elliot, Col. H. M., C.B., C.M.G., with rank of honorary Maj.-Genl., 1st July, 1921.
Farmar, Lt.-Col. W. C. R., from half-pay list, 1st July, 1921.
Gear, Lieut. A. F., from half-pay list, 30th June, 1921, with rank of Capt.
Gordon, Col. G. H., C.M.G., D.S.O., from half-pay list, 1st July, 1921.
Hawkes, Lt.-Col. C. St. L. G., C.M.G., D.S.O., from half-pay list, 1st July, 1921.
Holdsworth-Hunt, Lt.-Col. W. H., D.S.O., from half-pay list, 1st July, 1921.
Ingham, Col. C. St. M., C.M.G., D.S.O., from half-pay list, 1st July, 1921, with Hon. rank of Brig.-Genl.
Inglis, Major C. E., D.S.O., with rank of Lt.-Col., 8th July, 1921.
Jacob, Lt.-Col. W. H. B., D.S.O., from half-pay list, 1st July, 1921.
Kane, Lt.-Col. A. H., D.S.O., from half-pay list, 1st July ,1921.
Kennedy, Lt.-Col. A. C., D.S.O., (substituted for previous annnouncement), 20th May, 1921.
McDonald, Lieut. Arthur, 12th July, 1921, with rank of Captain.
Mills, Lieut. J. G., from half-pay list, 24th June, 1921, with rank of Capt.
Mooney, Capt. J., 6th July, 1921, with rank of Major.
Parker, Lieut. J. A., M.M. 6th July, 1921.
Richardson, Lieut. S. J., 3rd July, 1921.
Smith, Lt.-Col. A. G., from half-pay list. 1st July, 1921.
Williams, Lt.-Col. A. C., C.B.E., from half-pay lsit. 1st July, 1921.

Retirements with a Gratuity.

Aldridge, Lieut. A. W. 6th July, 1921.
Alexander, Lieut. J. B., 8th July, 1921.
Callingham, Lieut. E., 6th July, 1921.
Cook, Lieut. D., from half-pay list, 22nd June, 1921.
Freeman, Lieut. W. C., 6th July, 1921.
Kite, Lieut. A. F., with rank of Major, 14th July, 1921.
O'Reilly, Lieut. F., D.C.M., 23rd June, 1921.
Turner, Lieut. W. S., from half-pay list, 1st July, 1921.
Welsh, Lieut. S. H., M.C., 6th July, 1921.
Whelan, Lieut. A. J., 6th July, 1921.

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Resignations.

Blanch, Lieut. N. H., 16th July, 1921.
Brown, Lieut. C. W. C., 16th July, 1921.
Gordon, Lieut. D. McK., M.C., 7th July, 1921.
Parkin, Lieut. J., M.C., 13th July, 1921.
Thomas, Lieut. C. W. I., 5th July, 1921.
Williams, 2nd Lieut. L. B., 6th July, 1921.

Deaths.

Budworth, Maj.-Gen. C. E. D., C.B., C.M.G., M.V.O., died at Simla, 15th July, 1921.
Cotter, Lt.-Col. H. J., C.I.E., D.S.O., died at Sea, 28th June, 1921.
French, Maj.-Gen. Sir G. A., K.C.M.G., (Col. Comdt. retired pay), 7th July, 1921.
Marshall, Major E. T., 30th June, 1921.

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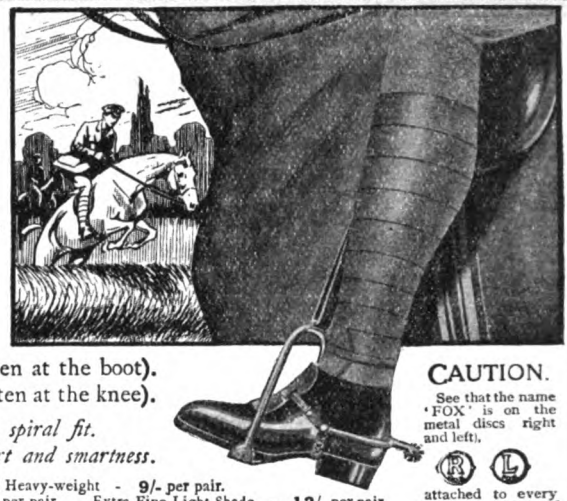

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"DUNCAN" HIGHLY COMMENDED ESSAY, 1920-21.

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for Horse Draught, both on the road and across country."

BY LIEUT.-COL. H. P. GARWOOD, D.S.O., R.G.A.

MOTTO: "ALAS, POOR DOBBIN!"

SYNOPSIS.

1. A motor battery pictured. 2. Advantages of Mechanical Transport. 3. Disadvantages. 4. American influence on Motorization. 5. U.S. report on motor lorries and caterpillars. 6. Recommendations of Westervelt Board. 7. Developments in America. 8. A few figures. 9. What nature of field artillery do we want? 10. Solo gun-mount or trailer? 11. Other possibilities. 12. Artillery and Tanks. 13. Need of standardization. 14. Summary and conclusion.

JUST over twenty years ago the petrol engine made its appearance on our roads and opened its campaign against the horse. At first the motor confined itself to the high-way and it was felt by horse-lovers that in military life at any rate (being perforce the sphere of open country) the horse would find a sanctuary. Then came the "caterpillar," monstrous and ungainly, but giving early promise of its brood of more capable successors: farm tractors, tanks and whippets. The petrol engine had taken to the fields. It could scamper over the heaviest plough, jump trenches, ford streams, and batter its way through hedges and barbed wire. Withal it had tireless energy and could carry a coat of mail. Horse-lovers clutched at straws. There were still places conceivable—slippery, rocky places— where the "caterpillar" might be useless; its mechanism was not yet fool-proof; our existing equipments performed all we required of them and had stood the test of time; it would be expensive to alter them; our petrol supply might fail; let us wait a little longer. Yet all the while we had an ominous certainty that this new prime mover had come to oust the horse from a position ennobled by centuries of service. Let us console ourselves that this innocent beast will in future be spared the agony of struggles in which he has no concern.

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(1). A MOTOR BATTERY PICTURED.

It will not be necessary to project our imaginations very far into the future to picture a battery of field artillery with motor traction and it may help to fix our ideas.

The general "turn-out" will perhaps lack the smartness to which we have been accustomed, but on the other hand, there will be an air of alertness about the whole unit, that look of "handiness" which comes to men who take a pride in tending well-tuned machinery.

The staff car is of curious appearance and has eight wheels. It runs at present on the two outer pairs and the inner pairs of "idlers" only come into play when the pliant *cingolis* (or track girdles) are slipped round the four wheels on each side and the car takes to the fields. Under the rear number plate is a small propeller[1] for use in crossing water (for the car is amphibious) and behind can be seen the bulky accumulators, tuners and frame of a wireless telephone outfit.

The battery has considerably fewer men than a horsed battery (only two drivers for each gun and ammunition truck) and all are carried on the vehicles. It will be interesting to consider a few approximate War Establishment figures to understand the nature of this saving :—

(i). A 6-GUN HORSED BATTERY.

Vehicles.	Horses.	Drivers.
6 Guns	36	18
12 Ammunition Waggons	72	36
2 Carts (cooks & water)	3	2
3 G.S. Waggons (supplies, etc.) ...	6	3
Spare	26	19
Grooms (say)		5
Farrier, Shoeing smith, saddlers and wheelers		9
Total ...	143	92

(ii). A 6-GUN MOTORIZED BATTERY.

Vehicles.	Transport Personnel.
6 Guns	12
6 Ammunition tractors	12
3 Tractors for stores and supplies	6
2 Tractors for water and petrol	4
2 Tractors (spare)	4
4 Reconnaissance runabouts	4
1 Signalling van	2
1 Workshop (including 4 fitters)	6
10% spare	5
Total ...	55 men.

[1] Or paddles can be fitted at the end of the spokes.

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A saving per gun of 6 men and 24 horses! The four battery fitters travel in a combined workshop and store lorry, fitted with lathe, drill, etc., primarily for vehicle repairs, though also (under the supervision of the I.O.M.) useful to keep the guns in action.

The guns are each on a separate truck drawn by an independent tractor. At present, being on the road, they are in the travelling position. The "girdles" are not fitted either to trucks or tractors and the "idler" wheels are not in use. The gun pedestal has been hinged back so that it appears to be lying on the floor of the truck and the gun has been elevated through a right-angle so that it appears to be lying on top of its recumbent pedestal. This is necessary to keep the centre of gravity low whilst travelling On coming into action, the "idlers" are first lowered to the ground by means of screwed rods running through the frame (or chassis) and the weight of the gun and mounting is thus equalized on to all the articulations of the system, which are then locked together to form as rigid a platform as possible. When the tractor is unhooked, it pulls the gun and pedestal into the upright position (this operation can also be effected by means of a tackle attached to the frame.) The gun itself appears to be a semi-automatic 18-pdr. perhaps slightly longer than our present ones. It has all-round shoulder traverse on a coned-pivot mounting, an elevation of 90° for use against aircraft and a controlled recoil. Two spare guns are carried in the body of the frame, so as to be ready when wanted and in the meanwhile giving ballast to the firing platform. The ammunition is loaded in boxes in 3-ton trailers and each tractor also carries a varying number of boxes to maintain (together with its diminishing load of petrol) the weight necessary for gripping the road. The motors are practically noiseless and the battery can do an easy 150 miles each day (including necessary halts for meals, overhaul, etc.). When it leaves the road, it takes from 5 to 10 minutes to fix girdles on all the vehicles.

This is just a rough conception of the type of field battery we are asked to consider. In order to discover whether such a battery (whatever its possibilities) is *desirable* for field (including horse) artillery, it will be convenient to tabulate the comparative advantages and disadvantages of mechanical and horse transport.

(2). ADVANTAGES OF MECHANICAL TRANSPORT.

(i). *Gun Design.* We can design our tractor to take whatever "weight behind the team" we may, in reason, find necessary to enhance the technical efficiency of the gun. It is no longer a question of so many pounds and no more. If we wish to lengthen our buffers or increase the weight of our gun, it is no longer a question of cutting away metal from the trail or lightening the limber. It becomes a problem of increasing the weight[1] and horse power of the tractor and adjusting the treads to retain a specified unit ground pressure. The design of the modern horse-drawn field gun has reached the limits

[1] A tractor may be taken as pulling its own weight.

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imposed by considerations of weight; and the scope for necessary improvement (all-round shoulder traverse, high-angle fire, higher M.V.) can be obtained only by the use of more efficient traction. Limits are here imposed by the weight-carrying capacity of temporary bridges, but with modern transport and constructional facilities. bridges may be left to adapt themselves to take the loads required. Tractors can make use of railway bridges without flooring.

(ii). *Mobility.* A tractor can go quicker than horses in draft and is capable of sustained effort out of all comparison. The Westervelt Board (whose valuable conclusions we shall refer to later) speaking of a "break through" says:—"during the phase of motion the animal is called upon for its maximum exertion, while receiving the minimum of care. Exhaustion is the natural result and therefore. as is borne out by the analysis of many experiences of the war, we may say that against an organized enemy, a break through is not possible with animal transport alone." The highly technical drill evolutions necessary with horse teams will not be necessary with motor traction. so time will be saved and gunners will be able to concentrate on their professional duties. The tractor can pick its way over bad ground more readily than a horse-team. It is also much more suited for keeping pace with infantry on the march, (e.g. in advance guards). It is sometimes objected that there is no point in field guns being able to move faster than infantry. We cannot say how infantry may be transported in future, but artillery requires its mobility for *lateral* movement, i.e. to effect speedy concentrations in support of, or to repel, surprise attacks.

(iii). *Economy.* Fewer men are required, less training and less fatigue. Tractors can readily be manufactured in England, thus obviating, in war time, the anxiety and expense of purchasing remounts abroad. In peace time, they can be stored indefinitely and do not consume fuel when idle. They occupy less space than horses, both on the road and when at rest, and are cheaper. The necessary fuel requires less transportation space than forage. The mechanical skill of the fitters is available also for the better upkeep of the guns.

(iv). *Hygiene.* Tractors are less vulnerable than horse teams; they are not affected by disease, exhaustion or climatic conditions. They cannot be gassed or stampeded and they present no sanitation problem (flies). They can transport the whole battery personnel, who are thus brought into action without undue fatigue.

(v). *Personnel.* In peace time the mechanical training necessary will be a valuable education to drivers, fitters, etc. and this should enable us to procure a desirable quality of recruit who will be interested in his work. When the tractors are not in use, the drivers can be taken to help shift ammunition, etc. Tractor drivers are very much less exposed than horse drivers and can easily be given splinter-proof protection in their vehicles.

(vi). *Camouflage.* Tractors can be inconspicuously designed and leave less "track" than horse-drawn vehicles.

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(3). DISADVANTAGES OF MECHANICAL TRANSPORT.

(i). *Unfamiliarity.* Our Artillery has the "horse tradition" and it will be difficult to switch interest on to mechanical matters of which most senior officers must of necessity be more or less ignorant. Tractors are subject to faults and derangements which require skill and patience to put right and a new scheme will require at the start, not only sympathy but enthusiasm. We shall have to make up our minds to re-educate ourselves and to give a fresh orientation to all our ideas of training. With the present demand and the salaries offered in civil life, we cannot expect to enlist skilled men. Complete technical instruction will therefore have to be given to recruits.

(ii). *Noise.* At present motor transport, especially the caterpillar variety, is very noisy. It is true that so many other modern arms are noisy (e.g. tanks, aeroplanes) that perhaps one additional noise will only further confuse the foe. But the noise factor is not irremediable. The use of steam may overcome it in one direction and in the other, rubber and ball-bearings will doubtless come to the rescue.

(iii). *Mechanical Inefficiency.* This will also right itself in time. At present there are certain defects. The tractor behaves very badly on particular slippery surfaces. This difficulty can be overcome by the use of geared capstans and tackles, driven by the motor of the tractor. These capstans are so useful in specific instances (e.g. getting guns into or out of railway trucks or into prepared emplacements) that they ought in any case to be fitted. The centre of gravity of caterpillars is apt to be too high, leading to ditching in awkward places, but this is already being rectified. The crossing of streams of any depth presents difficulties, but these can be surmounted by bulk-heading the engine so that it can work for a short period below the water surface. With unskilled personnel there is a feeling of despair when a tractor breaks down at a critical moment. A live horse, even when sick and exhausted, can be persuaded to make an effort: if a tractor fails and the cause cannot be located, all hope seems lost. Such disaster can only be obviated by a high standard of mechanical training and the provision of an adequate reserve of tractors and spares available on the spot. Furthermore, the tractor must be provided with fuel. It cannot, in emergency, exploit the grazing resources of the country like the horse. Finally, if we are still to contemplate the possibilities of investments, the tractor cannot be regarded as a reserve ration "on the hoof."

The above are the *pros* and *cons*, fairly presented. The case for the tractor is so promising that it seems we should be more than foolish to neglect to give it a fair trial. Before proceeding to consider the immediate problems facing us if and when we change from horse to motor traction, it will be well to glance at what the United States have been doing in this connection. The problem has received serious consideration across the Atlantic and is already the subject of close experiment. In a matter of this kind we cannot afford to neglect opinions and lessons from the birthplace of such miracles as the Holt tractor, the Ford van and the Lewis gun.

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(4). AMERICAN INFLUENCE ON MOTORIZATION.

Prior to August 1914 the question of expense had handicapped experiment in artillery motor traction. The use of London omnibuses for transporting troops had been tried and a battalion of Guards had been successfully conveyed to the Essex coast. The "Lion" steam tractor was regarded as the most suitable agent (if horses were not available) for the movement of heavy howitzers.

On the outbreak of war it was immediately clear that motor vehicles would play an important part in moving artillery. Unfortunately it was then too late to start designing special tractors or tractor mounts. The British, Germans and Italians (except for anti-aircraft guns, which all nations placed on lorries) confined themselves to the adaptation of commercial lorries and caterpillars for pulling their guns. The French during 1917 recognized the necessity and advantage of cross-country mechanical transport and developed platform caterpillars for carrying their 155$^{m}/_{m}$ howitzer mounted on its wheeled carriage. Motor traction however was regarded as a problem altogether apart from animal transport and, until the Americans entered the war, the armies (with the possible exception of the French) entertained no idea of replacing animal draft by the motor.

"The United States approached the subject of motorization from the standpoint of obtaining a better means of transport for its artillery than that offered by the draft animal. The result has been a mechanism which directly replaces the team in draft, giving at the same time a better performance because whereas animal transport, especially with lighter weapons, possesses great mobility; it does not possess a sustained or persistent mobility. Exhaustion surely renders it inactive after a limited period and the time required for recuperation is fatal if coincident with a critical point in military operations. This question of the exhaustion of animal transport is best illustrated by analysing the mechanics of the forward push or break-through, which is the object sought for in the struggle for a military decision. Our offensive military machine must be designed not only to fit every phase in the mission of breaking through, but also to remain intact when the breaking through has been accomplished."

Immediately after the Armistice a board of U.S. officers (the Westervelt Board) assembled in France to consider the whole field of artillery development and to make recommendations. The members visited the various allied Headquarters, workshops, etc., and took all the advice they could get whilst matters were still fresh in the minds of those with greatest experience. Their report therefore is entitled to respect.

Before considering the actual problem of motorization it is first necessary to decide the size and type of the guns it is required to transport. The Westervelt Board define their "ideal light field artillery" as follows :—

Gun. About 3″ calibre. 80 degrees elevation; 5 degrees depression and all-round traverse. Projectile not weighing more than 20 lbs. Shrapnel and H.E. of good man-killing power, with maximum range of

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15,000 yards. Fixed ammunition. Smokeless, flashless propellant. Time fuze for shrapnel. Bore-safe super-quick and short-delay fuzes for shell. The H.E. should be of one type only, designed for maximum ballistic efficiency with the largest bursting charge compatible with that object. For cheapness, semi-steel may be used provided it has the same ballistics as the standard shell. Two charges should be furnished 90% a normal charge giving about 11,000 yards range and 10% a super-charge of maximum range. The ballistics of H.E. and shrapnel should be the same, regardless of the type of fuze used. Maximum rate of fire : 20 rounds per minute.

Howitzer. About 4·2″ calibre. 65 degrees elevation, 5 degrees depression and all-round traverse. Carriage if possible interchangeable with that for gun. H.E. and shrapnel weight about 30—35 pounds. Maximum range : 12,000 yards.

Transport. Mechanical transport is the prime mover of the future. It is most important that design, experiment, and test of self-propelling caterpillar types, also of caterpillars for draw-bar pull, of wheeled trailers for long rapid hauls, and of similar ammunition vehicles, be vigorously pushed. For normal use a maximum speed of 12 miles per hour is sufficient. The introduction of mechanical transport will undoubtedly cause far-reaching change in the types of gun-carriages. It is not possible now to state just how far this will go or whether a gun mounted on a self-propelled vehicle or one mounted on some type of trailer will be the final result. Both types may be necessary. It is urgent that study and development be vigorously carried on along these lines, as we are on the verge of changes fully as radical as the introduction of the long-recoil field gun carriage, and the country first utilizing the new capabilities opened up by mechanical traction and the caterpillar will have a great advantage in the next war. A limit of 4500 pounds behind the team has heretofore been universally imposed on artillery of this class. The corresponding limit in the future will probably be that imposed by pontoon bridges.

(5). U.S. REPORT ON MOTOR LORRIES AND CATERPILLARS.

"The artillery is most interested in the type of lorry best suited for bad road conditions. The U.S. Marine Corps which has had to use motorized field artillery for some of its minor operations adopted, after many tests, the Four Wheel Drive lorry to handle its artillery. Throughout the war, the English, French, and Russian governments purchased considerable quantities of lorries driven on all four wheels for use in their artillery services, and as late as July 1918, the French made an urgent demand on the American E.F. for 300 such lorries. The F.W.D. lorry has such power, application and weight distribution as to assure movement of the vehicle if traction can be obtained even by one wheel.[1]

[1] The F.W.D. type lorry has differential gear on both front and rear axles, so this statement could only be correct if each wheel (or the wheels on each side) could be fitted with independent brakes.

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"Up to the autumn of 1917, there had not been found a type of F.W.D. lorry as refined in mechanical details as some of the higher types of ordinary lorries. This was natural, as the F.W.D. arrived late in the field. However, the Ordnance Department undertook the development of a F.W.D. lorry that would not have any of the defects of the F.W.D. commercial types. This lorry was ready for production in May 1918, and was recommended by a representative board of officers for adoption as the standard type of F.W.D. lorry for the U.S. Army. In the opinion of the (Westervelt) board, the four-wheel drive, two-wheel steer type of lorry is the only heavy cargo carrying wheeled vehicle which is adequate to meet artillery needs in the battery as well as in the ammunition train."

The Board points out the superiority of the "caterpillar" over all other mechanical prime movers across country. "The whole vehicle may be said to constitute a wheeled mechanism which lays its own track as it moves over the ground. By articulating the track and the frames or trucks which mount the wheels, the varied ground surfaces are accurately conformed to—a feature which further insures traction. The power is applied in such a manner that an individual drive is assured on each of the two tracks. With such a structure, movement is assured over very soft ground owing to low unit pressure, usually about 5 lbs. per square inch. The caterpillar can span wide gaps or ditches and climb steep slippery grades. The grip on the ground is secured by cleats or grousers which project approximately three inches from the surface of the treads. With the grousers removed, the caterpillars do not seriously damage hard roads. The above advantages make the caterpillar the only logical prime mover to replace the team in draft.

"Serious and practical experiments with the caterpillar for artillery transport were started in the United States in 1914 and the next year a commercial farm tractor of the most promising type was tested by the Field Artillery Board, resulting, in 1916, in the complete re-design of a number of such vehicles to adapt them to field service. This re-designed caterpillar still contained many small weaknesses, the elimination of which led in 1917 to the manufacture of the present artillery tractors.

"Weapons of various sizes have been placed on experimental self-propelled caterpillar mounts, namely:—the 75$^{m/m}$ gun, the 155$^{m/m}$ G.P.F., the 8″ Howitzer and the 240$^{m/m}$ Howitzer.

"To date (May, 1919) with the exception of 50% of the 75$^{m/m}$ guns in the combat divisions, the motorization of all artillery mobile weapons has been authorized and would have been put into effect had the war lasted a few months longer, or if shipping had been available. At the cessation of hostilities, sufficient tractor equipment had not been delivered in France to carry out this project. This was unfortunate, for many of our artillery personnel had had experience with commercial farm caterpillars, with their serious defects and inadaptability to artillery transport, and had consequently formed erroneous opinions based on such performance. It is, however, interesting to note the re-

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ports of those artillerymen who were fortunate enough to have received even a small proportion of the adequate allowance of motor equipment in its present stage of development for artillery purposes."

(6). RECOMMENDATIONS OF WESTERVELT BOARD.

"The maximum speed for draw-bar tractors should fall within a definite scale of approximately 12—8—5—3 miles per hour,[1] with such a total reduction in each case for low gear as to provide a sure means of pulling out under all conditions. It is apparent when good roads exist and traffic conditions are such as to allow their employment by artillery, a great loss of time is involved where long marches are necessary. The only solution is the employment of sprung rubber-tyred wheeled vehicles to transport the tractors and gun material, using a high-speed wheeled lorry as the prime mover. With such an arrangement, sustained movement over long periods at a speed of 15 m.p.h. may be economically accomplished. At the present stage of development, the trailer is the only available medium, but we can easily conceive the application of sprung rubber-tyred wheels to the tractor as an inherent part of its construction, in such a way as to permit the tractor to be transformed quickly into a wheeled trailer. This however would still require a lorry to pull it—the next and ultimate step is to utilize the power plant of the tractor to drive its self-contained wheels. We shall then have a self-propelled vehicle capable of operating as a caterpillar across country and also, at a moment's notice, capable of conversion into a lorry operating at high speed on good roads.

"While improving the caterpillar lorry-tractor, gun design will also progress; but with the weapon upon its wheeled carriage, a point will soon be reached where no improvement is possible. In all probability such a weapon and carriage will embody the split-trail feature, large angles of elevation and traverse, lightness coupled with stability and high power. But such a unit is not the limit of progress, for we have the broad field presented by the possibilities of the gun mounted directly upon a self-propelled vehicle. Already, the self-propelled caterpillar gun-mount is well along in the experimental stage and has passed from fancy to fact, and although the weights are excessive, the traverse limited and slight re-laying necessary, the results arrived at indicate final success in the near future. This success will be realized in a gun using, possibly, a pedestal mount, possessing perfect stability, all round fire, 90 degrees elevation, mounted upon a caterpillar-lorry tractor.

"It will be necessary to develop the following tractors :—

(a) A small cargo carrying caterpillar without power plant, to be pulled by two men as a cart, with some method of operating ratchets to drive the tracks over difficult ground. Such a vehicle is primarily an ammunition carrier, whose use is limited to stationary warfare.

[1] It must be remembered the Board is considering heavy as well as field artillery.

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(b). A small unit having wheels or caterpillar treads, driven by a very light engine, the whole being operated by a man on foot, total weight being such that it can be readily man-handled by the operator. This vehicle is for transport of heavy machine guns, guns accompanying infantry, ammunition supply and for laying wire.

(c). A light weight tractor for the motorization of the individual man. This tractor would have a very low C.G., 40″ wide over-all, articulated tracks approximately 6′ × 8′, with small body for carrying 2 men or 500 lbs. load, water-cooled engine capable of operating under water and at all possible tipping angles, with speed ranges from a sure low reduction of 3, 8 direct drive, 12 over-drive m.p.h. This tractor to be designed for replacing the horse of mounted individuals for use in reconnaissance, for pack transportation, including machine and mountain guns, for transport of ammunition, laying wire, etc.

"In general, the ranges covered by the proposed and existing equipment will appear as follows :—

The tractor cart for light loads up to 200 lbs. The $\frac{1}{4}$ ton tractor replaces the riding horse or carries loads not exceeding 500 lbs. The $2\frac{1}{2}$ ton tractor replaces the 6-horse team or hauls loads not greater than 6000 lbs.

"The 3-ton lorry is too heavy for divisional use. For this an F.W.D. lorry of 1-ton or 30 cwt. capacity is necessary in order to operate over very bad roads or ground. The tyre may be pneumatic 36″ × 6″, compound filled to prevent puncture. The need for the development of such a vehicle has been felt for many years in connection with the motorization of the lighter weapons.

"A great effort should be made to develop the caterpillar trailer. Such a vehicle with a cargo capacity of 30 cwt. should be designed, tested and put into production, to replace the 75$^{m/m}$ gun and light field howitzer ammunition lorries in motorized units. The horse sections of the divisional ammunition trains should be replaced by tractors pulling caterpillar trailers.

"While there is great promise for self-propelled gun mounts, those at present in existence and under test are, for the most part, excessively heavy. The most promising is the 75$^{m/m}$ gun mounted on an approximation of the $2\frac{1}{2}$ ton tractor. This mechanism, when carried on a 4-ton trailer and hauled by the 3-ton F.W.D. lorry, is capable of going over good roads at considerable speed, and after being demounted from trailer can proceed across country under its own power. It should be immediately developed to the utmost, paying particular attention to mobility and lightness consistent with strength and stability."

(7). DEVELOPMENTS IN AMERICA.

Since the Westervelt Board made the report from which the above is extracted, considerable progress appears to have been made in the United States on the lines proposed. The following are details of the $2\frac{1}{2}$ ton tractor, 1920 model, designed to pull the 75$^{m/m}$ field gun, the 105$^{m/m}$ howitzer or the 30 cwt. ammunition trailer. It has been favourably reported on at trials.

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Weight, 6000 lbs. Draw-bar pull 5500 lbs.

Length, about 12 ft.; width, 58 inches.

B.H.P. 50 Giving, at 1600 R.P.M., four road speeds from 1 to 12 m.p.h. (15 m.p.h. by over-speeding engine). The tractor is armoured against shrapnel and can go through 4 feet of water.

The 30 cwt. tractor caisson (B.H.P.32) develops the same speed as the tractor just described. It weighs 4000 lbs. with a load capacity of 3000 lbs. and has a rubber track. The Americans have also placed a 75$^{m}/^{m}$ gun on a self contained motor mounting (see illustration). The

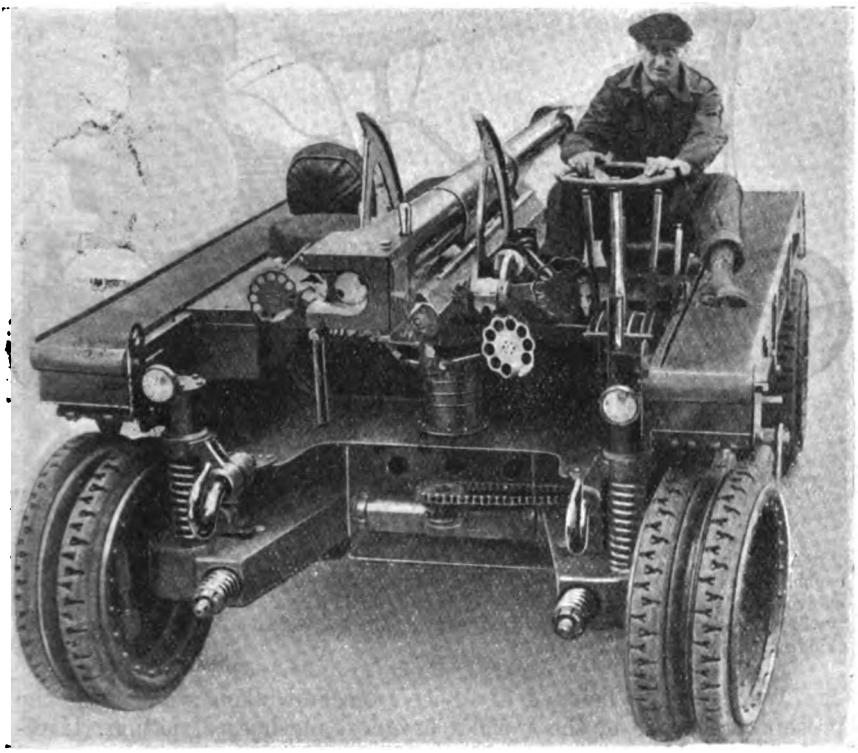

Photo: *Photo Press.*

AMERICAN 75 mm. LORRY-MOUNTING

(Illustration reproduced by courtesy of the Editor of *Conquest.*)

total weight of gun and vehicle is 6½ tons and it has recently made the trip from New York to Washington in seventeen hours, averaging over 12 m.p.h.

A very interesting vehicle is the "Reconnaissance Tractor" *designed to replace the horse for mounted work.*[1] This weighs 1000

[1] See also a very interesting experiment described in the *Automobile Engineer* for June, 1921, in which an *Overland* car and a 2¾ H.P. *Douglas* cycle are fitted with flexible track. The latter was steered by bending the front of the track and accomplished 20 m.p.h., over meadowland. *(Illustration overleaf.)*

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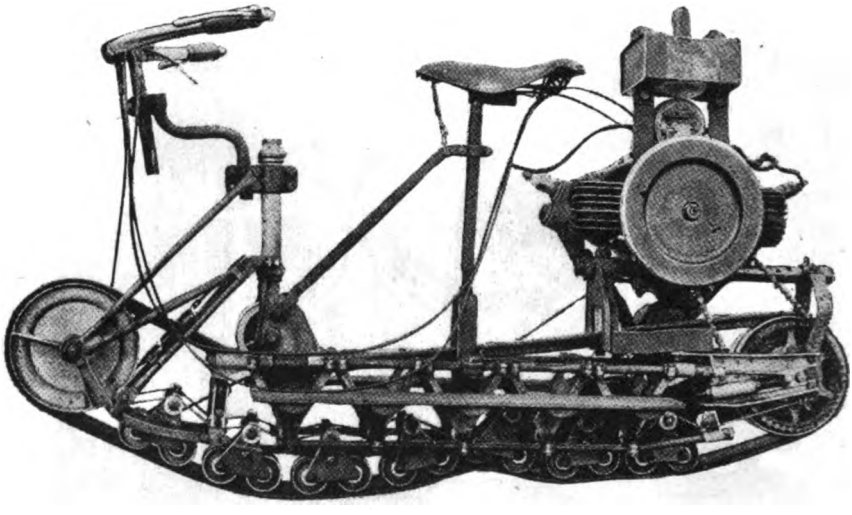
lbs. and in the experimental model "the unit ground pressure is so low that it can cross marshes where a man on foot cannot walk." It measures 104 by 44 inches and has a cargo capacity of 500 lbs. (it carried 5 men on trial). With 15 B.H.P. it develops speed up to 30 m.p.h. and is fitted with removable wheel tracks, each composed of two light rubber bands with metal cross slats. A remarkable feature is that "it runs directly off land into water, where it is worked by a small propeller."



By courtesy of "The Autocar."

THE HORSE OF THE FUTURE ?

A caterpillar "scooter" propelled by 2¾ h.p. Douglas motor cycle engine, and capable of running at 20 m.p.h. over meadowland or broken country. It has been evolved by the Department of Tank Design and Experiment for the purpose of testing the possibilities of employing flexible tracks, steerable without braking and skidding.

We have now listened to advice from and taken a glance at the present procedure of the world's foremost mechanical nation. It remains to consider our own problem. Before doing so it will be as well to recall the limitations of an essayist on the threshold of such a vast untravelled field. Small purpose will be served if he gives free rein to his imagination. Where the path seems clear to prophetic vision, a "field trial" may disclose an insuperable obstacle right in the foreground. Where an eventual economy appears undoubted, the public may grudge the ready money required for the immediate change. We can only hope to thread our way through the initial difficulties, getting a clear view of our requirements. and to propound reasonable theoretical standards to which practice may not despair of approximating.

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(8). A FEW FIGURES.

The following comparative figures are here inserted for reference and consideration.

(i). Details of Guns and Howitzers.

	Calibre in inches	Length in Calibres	M.V. f/s.	Range at 16°	Range at 30°	Weight in tons	Horizl. recoil inches.
12 pdr. (12 cwt).	3	40	2195	7300		·6	11
18 pdr.	3·3	28	1615	6600	9800	·43	48
4" (31 pdr.) ...	4	45	2600		13700	2·14	15
60 pdr.	5	32	2080	9200	14300	2·17	55
6"	6	35	2354		14900	4·57	42
7·5"	7·5	50	2800	14500		14·56	18
3·7" How. ...	3·7	11·8	798		4210	·2	35
4·5" How. ...	4·5	13·3	975		5600	·43	40
6" How. ...	6	13·3	1216		8750	1·3	54

(ii). Weight of Equipment Ammunition per Field Gun or Howitzer.

	18 pdr.		4·5" How.	
	Rounds.	Weight. (tons.)	Rounds.	Weight. (tons.)
With Battery	176	2·2	108	2·36
In Ammunition Column ...	76	·95	48	1·04
Total ...	252	3·15	156	3·4

An Ammunition wagon carried 76 rounds 18-pdr. or 48 rounds 4·5"
A G.S. wagon carries 108 rounds 18-pdr. or 66 rounds 4·5"
A G.S. limbered wagon carries 56 rounds 18-pdr. or 24 rounds 4·5"

(iii). Percentage Weight of Explosive in H.E. Projectiles.

12 pdr.	10·4	60 pdr.	10·4	3·7" How. ...	8·8
18 pdr.	5·7	6 inch	8·2	4·5" How. ...	12·2
75 mm. (French)...	15 5	7·5 inch ...	11·4	6" How. ...	8·2
4 inch	15·4				

(9). WHAT NATURE OF FIELD ARTILLERY DO WE WANT?

Before considering the nature of our travelling gun-platform, we must decide what weights we propose to put on it. Motor traction delivers us from the trammels of "weight behind the team" and leaves us free, within reason, to choose the most desirable weapon regardless of weight considerations. Are we satisfied with the general performance of our present field gun? Or do we require greater range? A heavier shell, with higher percentage weight of explosive? Do we

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require field howitzers as well as guns? Or shall we be content to compromise with a gun-howitzer? The answers to these questions affect not only weight, but also design in the "carriage."

One of the biggest surprises of the war, because it ought not to have been a surprise at all, was the discovery of the "forward observing officer." Prior to 1914, the rules laid down that fire was always observed from the vicinity of the battery. To use the map was not "playing the game" and although the range officer had a telephone he was "not allowed to tell" until the shooting was concluded. The effect of forward observation (whether carried out from the trenches or by aeroplane) was to increase the importance of range, which had previously been limited in utility by the extent to which the fall of rounds could be viewed from (practically) the battery position. The new conception enabled the shell to perform much of the movement which under pre-war training manual conditions would have had to be effected by altering the battery position. Let us take an illustration. An expedition is now attempting to ascend Mount Everest, the summit of which has never yet been scaled by man or mountain-gunner. If an observing officer could accompany the party (Mr. Finch is in fact a gunner) with a wireless set, it would not be impossible, within a few moments of arriving at the top, to deliver there a projectile.

If it were not so expensive, it might be a useful way of sending up their rations.

Increased range thus enables a battery to make its metal felt without undue transport exertion. The shell does the travelling. It is also useful to remember that the area over which a gun can fire in any sector increases as the *square* of the range. Thus by increasing the maximum range of a gun from 10,600 yards to 15,000 (just over 40%) we increase the area over which it can fire by 100%. In practice we do even more than this, because all the *increase* is in the enemy's territory, whereas probably one quarter of the original fire-sector is wasted in our own lines. It would seem therefore that by employing guns of greater range, we could do with fewer guns and keep them in safer positions. To take an extreme case: A continental nation is experimenting with a super-velocity gun (on the lines of Big Bertha) which is said to have a range exceeding 200 kilometres. It is conceivable that a battery of 100 such guns mounted in the capital could put down a barrage anywhere along the frontier. No transport would be necessary for the guns. Such a notion is clearly fantastical; but it indicates a trend.

Why then do we not wish for extremely long ranges in our field-gun? The reason is that we cannot get long range without unduly increasing weight, either in the weapon or in the projectile. The unwieldiness of super-velocity guns is well known and the demands of increased range on the weight of projectile are well demonstrated by a text-book example:—

Calibre.	Weight of shell.	M.V.	Time to R.V. 1000 f.s.
3″	14 lbs.	1550 f.s.	5·79 secs.
6″	100 lbs.	1550 f.s.	10·25 secs.
9″	360 lbs.	1550 f.s.	16 secs.

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The effect of calibre and high M.V. on transport weight may be judged from the following figures giving the gross weight of one round *boxed* or packed for field use :—

6-pdr.	...10—13 lbs.
13-pdr.	...21—31½ (H.V.) lbs.
13-pdr. (16 lb shell)	...26—31 lbs.
18-pdr.	28 lbs.
4-inch (separate ammunition)	50 lbs.
4·7-inch (separate ammunition)	83 lbs.

With the increasing demands of modern war on man-power, shipping and road-space, the problem of weight, with all that weight represents (i.e. expense in material and labour of manufacture and transport, the whole enhanced by the wear and tear of the guns themselves when high velocity guns of large calibre are employed) is indeed a serious one. Fortunately, in the case of the field gun, the problem is decided for us by other considerations. The primary rôle of the field gun is man-killing and we may liken the artillery of an army to the supply of hot water in a rest camp. If we want all in camp to have hot baths we must provide an ample supply of hot water. This means large boilers and plenty of coal. If however the supply is limited (as in practice it always is) unless we take special measures, a few early risers will enjoy all the hot water. So we lead our water through fine sprays or showers which enable everyone to use just as much hot water as is necessary, and no more. The reader is doubtless familiar with the device. It enables everyone to get a sufficient share of hot water. In the same way we desire each of the enemy to get a sufficient share of our field artillery projectiles and, the supply being limited, we divide it up into fine sprays or showers which will enable each foeman to get just as much as is necessary to kill him, and no more. This principle of economy of effort is a useful one to bear in mind (for instance, when comparing H.E. and shrapnel). The experience of all nations has shown that a projectile of from 15 to 20 lbs. weight fulfils this purpose satisfactorily. (The French shell weighs about 16 and the German 15 lbs.) Our own field artillery projectile has proved itself second to none and there seems no good reason to alter its weight.

But unfortunately increased range demands increased weight somewhere. Other things being equal, it is undoubtedly necessary to give our field gun as long a range as possible. It has already been pointed out that this increases in a high ratio the area covered by the gun. Furthermore, if we are to consider that in the future it may prove necessary for all guns to take their share in the struggle against aeroplanes, a long (or rather high) range is essential. The main disadvantages of long range are two. First, the gas pressures to produce the necessary velocity lead to rapid wear and consequent frequent replacement of the gun and secondly, with high velocities, the walls of the shell have to be stronger and the explosive content is correspondingly reduced.[1] These objections can probably best be surmounted by

[1] The use of inferior metal in mass production also leads to poor explosive content.

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providing a long range shell proportionately heavier so as to give greater range and preserve the same explosive content with increased strength. We already have reduced charges, so this would result in three different field-gun cartridges. With H.E. and shrapnel for each, this means six kinds of ammunition, not to mention the already serious complications due to different fuzes. It is for consideration whether such confusion (and lack of economy, because divisional artilleries have to carry about proportions of each kind, some of which they would rarely use) could not well be lessened by confining shrapnel to the normal charge. It seems however very desirable to have this greater range, so we will take it that the field gun of the future will be of the same calibre, but slightly heavier than the present weapon.

The "gun-howitzer" does not seem a desirable arm for the divisional artillery, at any rate as a "solo" arm. It suffers from the usual drawbacks of a compromise, being neither a first class gun nor a first-class howitzer. The low velocity of a howitzer has the valuable advantage of enabling it to fire a shell with a large cavity for explosive. It is explosive which counts in the rôle of the field howitzer, and if it is going to be given a stronger shell, then it must also be given a larger calibre and consequently more weight. Our present excellent field howitzer could doubtless be improved in the matter of range; so we may take it that, as in the case of the field-gun, the field howitzer of the immediate future will be slightly heavier than the present one.

(10.) SOLO GUN-MOUNT OR TRAILER?

Thus our transport problem is to provide conveyance for field guns and howitzers not differing greatly in size from our present weapons. The question at once arises:—Should the gun vehicle be self-propelled or should it be drawn by a separate tractor? At first sight it would appear that our optimum should be the self-propelled gun-mount. A variety of considerations, however, seem to tell in favour of the separate tractor and it will be as well to state these in detail.

In the first place, it is manifest that motor traction is rapidly improving. Each year produces new "models" with features which gradually prove their merit and become embodied in standard manufacture. It seems clear (chiefly as a question of economy) that it will be much easier to take advantage of such improvements if the tractor is a separate unit. The same applies in a lesser degree to the independent gun chassis. Radical alterations in the gun are not likely to be so frequent as those in the motive power, but nevertheless it is as well to keep them in view from the beginning and to avoid the necessity of having to scrap the motor portion of the mounting whenever we wish to introduce a new "mark" of gun or carriage. The importance of this consideration is brought home to us from the outset if we realize the importance of replacing the horse-teams of our present field guns as soon as possible. With slight alterations in the existing carriage (which should not be insuperable when the "weight behind the team" factor is no longer paramount) there is no reason why our present

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18-pounders should not be tractor drawn. At the worst, the speed of the motors might have to be limited to that of the horse and, human nature being what it is, this would probably necessitate the use of an effective "governor" on the motor. But double-tyred wheels could be fitted at any rate to the split-trail type and with ball bearings and a system of springing (as in the Filloux and some of the German mountings) there seems no reason to doubt that the speed of our present divisional artillery could and should be increased.

Other advantages of a separate tractor suggest themselves. The tractors for gun-mount and ammunition trailer should be identical. This will automatically provide a reserve of tractors (so far as the guns are concerned) in case of any being put out of action by enemy fire or mishap. A motor vehicle in use is much more likely to be in good working order than one which is lying idle, possibly for weeks at a time, as would be the case with a battery in action in static warfare. The tractors are less likely to suffer damage from enemy fire if they can be withdrawn from the battery position to a comparatively safe place near by. The employment of separate tractors also leads to economy in use whilst the battery is in action; and allows better facilities for periodical overhaul in the motor workshops.

Three further advantages may be claimed for the separate tractor. The tractor and trailer will have a greater track length than the motor gun-mount and the unit road pressure can be correspondingly reduced. The locking angle can be diminished. Finally (and experience has shown this to be of the utmost importance) a winch or capstan can be fitted to the tractor to enable it to haul the gun over difficult places or into railway trucks and prepared emplacements by means of wire ropes and tackles and also to withdraw guns under shell fire from forward positions by means of long wires.

The advantages enumerated above seem on the whole to be decisively in favour of the separate gun tractor. The self-propelled gun-mount however has one great advantage which will require a certain amount of adjustment in the case of the separate tractor. It has a good working weight on its tracks, made up by the gun mounting, motor and detachment. In the case of the separate tractor a difficulty arises in this connection. When travelling, the weight of the tractor must be at least as great as the gun trailer. The latter has the main weight—the gun itself—and no device for transferring any portion of this to the tractor (as with the 60-pdr. in travelling position) seems likely to be satisfactory. The tractor, on the contrary, has a diminishing load of oil and petrol which will be most lacking when most required, i.e. when approaching the battery position. Whilst travelling, we want the tractor to be at its maximum weight and the gun trailer to be as light as possible. In the firing position, on the other hand, the gun chassis must have ample weight to render it a stable platform. The tractor must also be able to shed some of its weight in order to go light when preceding the gun into awkward places where it is necessary to employ the winch and tackle. Whilst travelling, all weight should be "useful" weight; in position it may be

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necessary (though it is not desirable) to employ artificial weight, e.g. jack-arms and earth-boxes. We cannot count on the ammunition in this connection as in action that may be a diminishing weight. It has already been suggested that the object in view might be assisted by carrying two spare guns in recesses on the tractor whence they could be transferred, on coming into action, to similar recesses on the gun chassis. With the existing field gun or howitzer such a transfer would represent just under a ton. In addition, spare parts (both gun spares and tractor spares) could usefully be carried on the tractor. The tractor could then be made up to the required weight (probably 2½ or 3 tons) by ammunition which would eventually constitute the first supply for the gun. Eighty rounds of field gun and 46 rounds of field howitzer ammunition go to the ton and in each case bulk about 35 cubic feet. Ten men also represent a ton and the detachment would form the liquid weight to transfer to the tractor as fuel disappeared. Vehicles with caterpillar tracks can be grossly overloaded; so no difficulty should really be encountered, provided the problem is not lost sight of in design. The weights quoted for ammunition include existing packings, but eventually with motorized artillery the rounds will be boxed in a more economical and convenient manner and weight will be saved.

(11). OTHER POSSIBILITIES.

Although the separate tractor and gun mount seems at present the most straightforward and convenient solution of the artillery transport problem, it is of course quite possible that some simpler though less obvious contrivance may be evolved. There seems no reason why a small caterpillar mounting should not travel in a suitably prepared lorry. The lorry would go as far as the road allowed and then deposit the caterpillar to make its own way across the fields. Weight would probably present difficulties. The ideal would be a kind of alternate pick-a-back arrangement; the lorry carrying the caterpillar on the road and the caterpillar humping the lorry over the countryside. An interesting motor vehicle development which may have a bearing on this part of the question is the 6-wheel lorry lately placed on the market. The front four wheels form a lock under the body and the drive is on the middle pair. This gives a good adjustment of road weight and there seems no reason why the front four wheels (which in fact resemble a motor car and are about the same size) should not be replaced by a caterpillar tractor when occasion requires. The detailed consideration of such developments leads one too far away from actuality and they are only mentioned because they must not be lost sight of.

(12.) ARTILLERY AND TANKS.

A word may here be said about the use of Tanks for conveying guns. During the late hostilities a number of experiments were carried out in this direction with indifferent success, but not lacking in promise. One sometimes even hears it said that the next few years will decide whether the Royal Regiment swallows up the Tank Corps

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or whether the Tank Corps swallows up the Royal Regiment. To the present writer there does not seem the slightest chance of the Tanks absorbing us. The idea is based on the analogy between Tanks and warships. We have capital sea-ships armed with the heaviest ordnance; why therefore should we not have capital landships also so armed? The answer is that the conditions are entirely different. If the waves of the ocean were still and solid, so that we could drag guns over them and use them as fixed platforms to fire from; if also the sea were studded with "features" and forests like the land, so that we could conceal our guns; should we still put great guns into our ships? A sufficient answer seems to be provided by the respect displayed by navies during the war to coast fortifications, armed though the latter were with fewer and less potent guns. The *beau sabreur* school has already started the hare that Tanks are useless—that their fate has been sealed by land mines. The discerning will know what attention to pay to a thought so obviously fathered by an impious wish. Nowadays it is more than ever foolish to prophecy about developments in warlike material; but Cromwell's advice to "neglect no means" is still a lodestar and we should be more than foolish if we neglected to develop our Tanks to the utmost. Tanks have their own rôle and their own problems. They certainly require their own artillery armament. Their development may seriously affect the nature of the task before artillery; but whatever the Tanks may do, it will be the duty of artillery to counter them, and there exists no reason why artillery should fail to justify its separate existence.

Needless to say the above remarks are not penned in any spirit of jealousy, for it is essential that Tanks and artillery should work closely together. We can look to them for great assistance in our motorization problem and in turn must study their requirements both as regards armament[1] and tactical artillery assistance. But for a long time to come we may safely say there will be room on the battlefield for both arms and it would be disastrous if any feeling of rivalry were to arise. The Tank has pointed the way and shown that cross-country motorization is certainly possible. It has also shown that great speeds can be attained: the Tanks can manœuvre like cavalry and at least 5 m.p.h. quicker. It is necessary to emphasize that, although in emergency a Tank may be called upon to tow a gun, the Tank has its own business to attend to and furthermore is not the most suitable gun-tractor. We have already perhaps been given a false impression of the possibilities of motorization owing to the adaptation of farm-tractors to this purpose. The Holt tractor did such splendid service, that it is sometimes forgotten that it was a Cincinnatus not designed for the work of pulling guns. Neither is the Tank designed for pulling guns and with a suitably designed tractor we may expect much better performance than from either of these makeshifts.

[1] It seems a pity that a closer liaison has not sprung up between Tanks and Artillery in technical matters. Their gunnery problems are analogous to ours and our war experience should be useful to them. The "ship" idea has apparently led them to prefer the complications of Naval practice.

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It is sometimes said that the proper antidote to the Tank is another Tank. Unless we are prepared to have sections of protective Tanks waiting all along the battle front, this seems out of the question. The antidote to the Tank is undoubtedly the motorized field gun.

There can be no doubt that the present developments of the Tank as regards speed and manœuvring power have sounded the knell of the wheeled field-gun, whether provided with split-trail or the more familiar three-point support. *The shoulder-swung all-round-traverse cone or pedestal mounting has become essential,* and it is fortunate that caterpillar-treaded motor vehicles have simultaneously become a practicable proposition, as otherwise the problem could only have been solved in a cumbrous manner, if at all.

(13). NEED OF STANDARDIZATION.

It would seem a just economy and a desirable arrangement to employ a standard chassis for all field (including A.A.) guns and howitzers. The standard chassis would embody a universal cone or pillar with ball-races over which the different mountings would be designed to fit. The utmost standardization must be insisted on from the outset. The manufacturer's interest (which he will not fail to exploit) is to make us maintain a great variety of costly "spares." But in the stress of war, shortage of spares is a calamity, especially with motors, whole fleets of which may be held up for long periods awaiting some trifling accessory. Rigorous standardization is the remedy.

In the case of the ammunition trailer standardization will probably be even more necessary, because there seems no reason why this vehicle should not become the universal transport unit throughout the service, replacing the 3-ton lorry, the G.S. wagon and the G.S. limbered wagon. Its ability to cross country will make it extremely useful in general supply work and a compact weight-carrying vehicle will be possible, because forage, which is at present the only bulk load, will gradually disappear. It follows that this trailer should be designed to meet general army requirements, though specially strong floors may be required for artillery use. The introduction of such a form of transport will be an immense boon; because at present, although the Mobilization Store Table has been reduced to a minimum, batteries are finding great difficulty in carrying even the limited equipment demanded by mobile warfare.

(14). SUMMARY AND CONCLUSION.

To summarize conclusions. The American experiments have already shown that complete artillery motorization is possible, and they contemplate the use of such artillery on roads and in conditions as bad as any likely to be met with in our case. We require to concentrate on a tractor capable of doing 12—20 m.p.h. on good roads on rubber tyres and convertible at short notice into a track-vehicle doing 8—12 m.p.h. across the fields and wherever a horse team can go. It should be capable of hauling a 2½ or 3 ton load on caterpillar tracks;

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working for short periods with motor submerged and should be as noiseless as possible both as regards engine and girdles. It must be fitted with a vertical winch giving a good power with not too small circumference. For the present it should be used to haul our existing equipments which should therefore be adapted to endure the requisite speed over bad roads. At the same time experiments are necessary to obtain a caterpillar trailer mounting which will enable a proportion of guns to be mounted suitably for dealing with moving Tanks and also with aircraft. Eventually all field and anti-aircraft guns and field howitzers to be mounted on such a trailer. Compared with the above a general transport and ammunition trailer would seem to present little difficulty in design, but the general needs of the service must in this case be considered. As the mounted man will stand no chance of keeping up with such a battery, it will be necessary to evolve a reconnaissance runabout, capable of going anywhere a horse can go and with a good speed, say 30 m.p.h.

Where to begin? Prejudice is the chief enemy. The cult of the horse in military circles will be as difficult to eradicate as knight errantry at the Renaissance. It is essential for experiment to be conducted in a favourable atmosphere and removed from the influence of a generation which has made the horse its trusty friend. The motor is not going to be gainsaid, and the sooner we make up our minds to acclaim it the better. A small experimental unit suggests itself as a good beginning, with officers and men volunteers and selected for their mechanical knowledge and gunnery experience. It could be affiliated to the Experimental Brigade at Aldershot. Such a unit would delight in the fashionable pastime of "exploring avenues" and would give artillery mobilization a good practical start. It would take a pride in demonstrating that motors can be made to do everything the horse now does, but quicker, more cheaply and with less exertion. Needless to say, the motor transport personnel *must all be artillerymen*. Any other arrangement leads to friction or (which is nearly as bad) waste of energy expended on the continuous tact necessary to avoid friction. Discipline and *esprit de corps* are also affected. In a motorized unit a certain amount of foot-drill will be required if a high standard of discipline and smartness is to be maintained and duties generally will be more easily apportioned if all the men belong to one branch and look to one commander.

It would seem best to concentrate our first experiments on the field gun. If a noiseless equipment can be evolved, it might then be introduced into the horse artillery, where its superior mobility would have greatest scope and it would give the cavalry and female Tanks the support of a really useful weapon. Pack artillery has not been considered in this essay, but it may be said that its motorization is probably not so infeasible as at first sight it appears.

We must above all have our eyes on the future. As many officers as possible should be given opportunities and encouraged to obtain a good knowledge of motors and motor transport work. Especially in our military schools, the syllabus should be overhauled so as to give all

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cadets the best available instruction in the physical sciences, mechanics, electricity and the internal combustion engine, both petrol and oil. The task is not really a difficult one. We can afford to go slowly and evolve well thought out and carefully tested equipments. Before the war we were inclined to be parochial in our military ideas. Now we have rushed to the opposite extreme and tend to suffer from megalomania. The financial straits of Europe make it very unlikely that we shall have another large scale war against a highly organized opponent for a very long time. In any case, our task is the same : to make our small professional army very perfect; to give it the best equipment and to imbue it with the best ideas.

It is difficult to see how we can commence to approach this ideal without motor artillery, although the forces of reaction are likely to be strongly entrenched against its progress. We gunners are nothing if not conservative. We may fear that our Ahabs will trot out and extol the views of their tame prophets "speaking that which is good"—my horse's shall be as thy horses— with cunning pleas and strategical sophistries to delay unwelcome improvements. But if we go up to Ramoth-gilead equipped on the advice of these experts, it will be no bow drawn at a venture which will seek the joints of our harness.

It is much to be hoped therefore that this subject of artillery motorization will be whole-heartedly pressed by those who appreciate its importance. We are all at present delighting in the gradual return to pre-war procedure. Unless we are careful the same forces which made us revert to muzzle-loading guns at the end of last century will once again direct our efforts in the wrong direction. And this would be a pity because—except for pleasure purposes—the horse's day is over.

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ARTILLERY TRAINING FOR INDIAN PACK BATTERIES.

BY MAJOR H. J. G. GALE, D.S.O., R.A.

A BRIEF perusal of a borrowed copy of Artillery Training, Vol. I. (no official copies have yet been received in India) shows that, excellent as the book is, the same scanty attention is given to Pack Artillery as in the old "F.A.T."

This seems extraordinary considering the large increase in Pack Artillery which has taken place in the last few years.

It is hoped that the following notes showing the variations in detail and procedure necessary to suit the peculiarities of Pack Artillery may invite discussion and lead to addenda being inserted in Artillery Training in the near future.

The adapted methods of procedure have all been tested for some two months by the writer with his battery over various natures of ground and in connection with various schemes and have given good results.

The subject will be dealt with under the following headings :—

1. Composition and organization of the Battery Staff.
2. Formations.
3. Duties of British and Indian Officers and Indian Other Ranks.
4. Methods of occupation of positions.
5. Change of Position.
   (a). General procedure.
   (b) Special procedure for retirement by sections in Indian Frontier Warfare.
   (c). Alternative drill procedure.
6. Code of signals between Firing Battery and First Line.

1. *Composition and Organization of the Battery Staff.*

B.C's. PARTY.	"A" GROUP.	"B" GROUP.	CAPTAIN'S PARTY.
B.C. & G.P.O. ...	4 Signallers. (c)	4 Signallers. (c)	
1. B.C's. H.H. ...	1 H.H.	1 H.H.	Captain.
2. G.P.O's. H.H. ...	... ...	... ...	1. Hav. Major.
3. Signalling Hav. ...	... ...	... ...	2. Driver I. (d)
4. B.C's assistant. (a) ...	... ...	... ...	3. ditto. (d)
5. ditto. ...	... ...	... ...	4. H.H. for Capt. & 2.
6. G.P.O's. do. (a) ...	... ...	... ...	
7. ditto. ...	... ...	... ...	
8. H.H. for 3 (b) 4 & 5. ...	... ...	... ...	5. H.H. for 3.
9. H.H. for 3 (b) 6 & 7. ...	... ...	... ...	

For notes see next page.

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Notes.

(a). Pack Artillery is equipped at present only with the Mekometer; B.C. and G.P.O. therefore require 2 assistants each. These must be rangetakers.

(b). The Signalling Havildar will be up and down between Battery and O.P. He can therefore make use of 8 or 9 to hold his pony.

(c). Two of the four signallers of both "A" and "B" Group only are mounted. The two dismounted signallers in each group are accompanied by a telephone mule with Signalling pannier on one side and Cable khajawah the other. The reason for this is that Pack Artillery is not equipped with waist reels and reel buckets and the 12 inch drums which are supplied cannot be carried on horseback.

(d). As there are two Driver Indian Officers it is better to use one of them in place of the Quarter-Master Havildar. (This would seem also to apply to British Pack Artillery).
The other leads the 1st Line in the absence of the Captain, taking the place of the Farrier who does not exist in Indian Pack Artillery.

Distribution of Ponies. Number allotted 17.

The following distribution has been found satisfactory :—

Ponies.

Indian Officers	4
B.C's and Captain's H.H. (Trumpeters) ...	2
G.P.O's H.H.	1
Signalling Havildar	1
Havildar Major	1
2 Signallers "A" Group	2
2 Signallers "B" Group	2
B.C's Assistants	2
G.P.O.'s Assistants	2
	17

The balance has to be made up of Mules as follows :—

Battery Leaders H.H.	1
H.H. for I.O. with 1st Line	1
H.H. for mounted Signaller of "A" Group	1
H.H. for mounted Signaller of "B" Group	1
H.H. for B.C's A's	1
H.H. for G.P.O's A's	1
	6

Notes.

The two Gunner Indian Officers when acting as Section Commanders only require horseholders when battery arrives close to position. These therefore can be dismounted. When acting as G.P.O. or B.L. they can take over the latters horseholders.

If there is a shortage of Mules, H.H.'s for Battery Leader and Driver I.O. with 1st Line can be dismounted.

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Horseholders for B.C's and G.P.O's Assistants should be range-takers and should be instructed in duties of Assistants.

Similarly horseholders for "A" and "B" Groups should be signallers and should be worked in the Groups from time to time.

2. *Formations.* (Only Battery Formations are dealt with).

(i). *Column of Route.*

Firing Battery in single file moving off from the named sub-section, followed by 1st Line in the same order. Tactical.

(ii). *Column of Sub-sections.*

Column of single guns with 1st Line Right or Left or *in Rear.* The latter formation which is not given in A.T., is the normal formation used in Pack Artillery when owing to the narrowness of the road the battery cannot move in Column of Sections. Non-tactical.

(iii). *Column of Sections.*

Each Section moves complete with the 1st Line following the Firing Battery. Interval close, half or full. Distance between sections varies according to state of road. This is the normal formation adopted by Pack Artillery on non-tactical marches.

It has this great advantage, from the point of view of march discipline, that the Section Officer has his Section complete under his control.

(iv). *Battery Column.*

Sections in open column. All Firing Battery first then 1st Line in the same formation. Tactical.

Distance between F.B. and 1st Line varies according to the nature of ground, situation and enemy.

(v). *Disperse.*

Mules of each sub-section open out to 5 to 10 yards distance and scatter right or left of the line of advance of their sub-section. Tactical.

This formation can be used when battery is either in Line, battery Column or Column of Route and is adopted when open ground has to be crossed which is either under shell fire or observation.

Tarpaulins thrown over the loads increase the deceptive effect.

3. *Duties of British and Indian Officers and Indian Other Ranks.*

The duties of British Officers as laid down in A.T. require no alteration except in the case of the special procedure for retirement by sections in Indian Frontier Warfare.

A small variation also seems necessary in the Captain's duties during an ordinary retirement. These are dealt with under the heading *Change of Position.*

(a). *Gunner Indian Officers.*

Command Sections in absence of G.P.O. and Battery Leader; i.e., after preparation for action until battery is in action.

In action except when B.C. controls battery by voice, one I.O. will command G.P.O's Section.

During action if at any time the British S.C. of a Section has to leave his section his place will be at once taken by the I.O. of that section.

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I.O's should be trained in duties of G.P.O. and Battery Leader.

(b). *Driver Indian Officers.*

Assist the Captain. One accompanies him wherever he goes and is used by him to convey information back to 1st Line.

The other I.O. leads the 1st Line in the absence of the Captain. Driver Indian Officers should be instructed in the Captain's duties.

Note.—Now that Gunner and Driver Indian Officers have been placed on one list for promotion they should be able to carry out each others duties.

(c). *Havildar Major* and *Signalling Havildar,* the same duties as laid down for Battery Sergeant Major and N.C.O. i/c Signallers.

(d). *B.C's* and *G.P.O's Assistants,* the same duties as laid down in A.T., with the variation regarding mekometers.

(e). *"A" and "B' Group Signallers.* No alteration except in retirement by sections (see 5 (b)).

4. *Method of Occupation of a Position.*

All equally applicable to Pack Artillery but advantages claimed for the "Flank Method" do not hold water for Pack Artillery which would only use this method when forced to do so on account of narrowness of approach to the position.

5. *Change of Position.*

(a). *General Procedure.*

Requires no alteration except that in an ordinary retirement it would appear better for the Captain to go with the first line, as he is not required at the Battery Position.

(b). *Special procedure for Retirement by Sections in Indian Frontier Warfare.*

First a re-distribution of the Battery Staff is made viz.:

G.P.O. and B.L. become Section Commanders.

Signalling Havildar and One Signaller from "A" Group join the B.C.

G.P.O's and B.C's assistants join the Captain.

"A" Group less one signaller joins the right section.

"B" Group joins Left Section.

Section Officers distribute signallers between Firing Battery and 1st Line of their Sections. Then the Captain orders 1st Line of both sections to retire indicating direction and goes off himself with one Driver I.O. and Havildar Major, B.C.'s and G.P.O's Assistants to select the 1st position in rear.

The distance to this will vary according to ground and situation but should usually be between 800 and 1000 yards back.

Having chosen position he instructs B.C's assistants as to ranges to be taken, marking of positions of guns, zero line etc. He then sends Havildar Major to guide retiring section to position and to give the retiring section commander any necessary information.

The Captain then selects 1st Line position (or positions) and sends Driver I.O. back to guide 1st Lines of Sections to it (or them). As soon as the Captain has left, the B.C. details one section to retire.

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Assume this to be the Left Section of the Battery in action.

LX Commander calls up his F.B. Mules, and evacuates position. As soon as LX arrives at 1st position the Captain hands over B.C's Assistants with ranges etc., to the LX Commander and goes back with G.P.O's Assistant, Havildar Major and Driver I.O. to select 2nd position going through the same procedure as before. As soon as LX is in action the RX retires to the 2nd position.

As soon as RX arrives near the line of LX's position, 1st Lines of both sections retire to 3rd Position.

As soon as RX reaches 2nd position the Captain gives RX Commander ranges, etc., and goes back to choose the 3rd position, taking the G.P.O's Assistants with him.

This process is repeated till retirement is complete.

If the RX Commander should want B.C's Assistants he can take them over as LX passes. The same applies to LX Commander when retiring to 3rd position.

(c). *Alternative Drill Procedure.*

(i). Battery Leader sends for the Firing Battery Mules. The Firing Battery forms up on the position and moves off as a formed body. The 1st Line moves independently.

(ii). Battery Leader sends for Firng Battery and 1st Line Mules. The Firing Battery and 1st Line form up on the position and the whole move off as a formed body.

(iii). Battery Leader sends for Firing Battery Mules and orders position of assembly to be used. The Captain having chosen the position of assembly sends the 1st Line under its Indian Officer to it. The Firing Battery Mules go to the Battery position, guns are limbered up and each sub-section or section moves independently to the position of assembly.

(iv). Battery Leader sends for Firing Battery mules and orders position of assembly to be used. The procedure is the same as (iii) except that each mule as soon as loaded up moves independently to position of assembly.

In both (iii) and (iv) the Captain comes up to vicinity of Battery Position to direct mules to position of assembly.

6. *Code of Signals between Firing Battery and First Line.*

Signal.	Meaning.
P M	Prepare to move.
L U	Limber up.
F B	Firing battery mules to come to gun position.
S L	First Line to come to Gun position.
P A	Position of Assembly to be used.
A	Send up relief Wheel and Axle Mule.
B	Send up relief Carriage Mule.
C	Send up relief Trail Mule.
D	Send up relief Cradle Mule.
E	Send up relief Breech Mule.
F	Send up relief Chase Mule.
B B	Send up relief Bareback Mule.

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OPERATIONS OF THE HORSE BATTALION OF THE (GERMAN) 15th FIELD ARTILLERY, NORTHERN FRANCE, 1914.

BY LIEUT.-COL. A. SEEGER.*

From *The Artilleristische Monatshefte*, July-August, '20.

(Re-printed from the U.S. Field Artillery Journal, Jan.-Feb., 1921.)

THE 27th of September brought us more hard work. French territorial troops were appearing everywhere, generally without much artillery, and it was necessary to get rid of them, and clear the road to Bapaume, which place changed hands frequently at that time, after slight skirmishes. The 14th Reserve Corps, from Baden and Würtemberg, was coming up by forced marches from Cambrai, to occupy Bapaume and then move on to Albert; but that place did not fall into our hands until the great offensive of 1918. In 1914, at the end of September, the Swabian divisions could accomplish nothing, the enemy growing constantly stronger; division after division from the Aisne front was being brought to the left flank of the French and English, which was in the air.

On this day, the 27th, we rode over the battlefield of Le Transloy, where two days before there had been heavy fighting between our Jägers and General Pau's advanced troops. These engagements had always resulted in our favour; the French troops were of the older classes, not habituated to serious fighting, and suffered heavily when they came in contact with our picked men, who commanded my admiration every time I saw them in action by their bravery, coolness, and skill in the use of ground. These smart green riflemen shot remarkably well. I went out with two of them to a little group of trees in front, to get a look at the country; two men of a French patrol appeared, nearly a kilometre off. Our two men consulted a moment: "Range 800—900: one clip rapid fire." Both Frenchmen fell and did not get up again. It was a pleasure to work with such troops.

On this battlefield several hundred French dead were buried on the evening of the 28th, and there were still more uncollected. In front of the churchyard lay, as if posted as a sentinel, a handsome young French Captain, sword in hand. The shadow of death hung over the whole village, which was still burning from the bombardment. The troops took quarters in such buildings as were still standing, which gave a good idea of the wealth of the country; none had to bivouac.

* Translated by Colonel O. L. Spaulding, General Staff, U.S. Army.

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That afternoon I saw several dead lying in a field, and was just riding on, when I heard someone call me in French, in a weak voice. It was a badly wounded sergeant, with a broken leg; he had lain there thirty-six hours without assistance. He showed great gratitude when I promised to send a surgeon, but I answered that I was doing only my duty. Now, when we have learned through four long years of war, how cruelly our wounded were treated, I can quite understand that our common Christian duty was looked upon by some of the enemy as a surprising exception to the rule of ill-treating helpless men.

The next morning we were assigned to cover the flank of the advance guards of the Würtembergers, along the line of the Ancre about Miraumont, a country which later became famous. At daybreak our cavalry crossed the Bapaume-Albert road, and we had a moment to greet our friends from back in Swabia, and assure them that we were supporting them to the best of our ability. Such unexpected meetings on the battlefield stick for a long time in one's memory.

Just at this moment there came the message from our advance, very natural under the circumstances, that our patrols had been fired upon by infantry from the village of Pys, only three kilometres from the main road. These hostile troops, apparently a much surprised battalion, were retiring in all haste to the west. Then came the order, "Artillery to the front, and fire upon the retreating enemy." I put my 2nd Battery into position close beside the road, where the troops of the 27th Reserve Division were halted, and opened fire about 1600 m. beyond the village; but when I tried to lay a wire to the church tower there, we were again fired upon, and there was nothing to do but turn our fire in that direction, especially at the church tower, where observers usually take station. It gives one a peculiar feeling, to fire upon a village, lying peacefully in the morning sun, knowing that innocent people will probably lose their lives; but it was so ordered, and the situation required it. It might have been better if our strong cavalry had surrounded and rushed the village, and thus captured the enemy who later got away; but we did not know what was in there; a few cool, resolute men might have changed the whole situation.

It took some time to find this small target; but finally we got two hits on the tower, then limbered up to take a more advanced position, where we could see the enemy and continue the pursuit by fire. We came into action again near the village upon which we had just been firing, and sent a few shots into the valley of the Ancre after two companies which were falling back in great haste. Some of them had got into Beauregard Farm, where there seemed to be a considerable force, so we took that as a target. The range was only 2400 m., and every shot could be clearly observed.

Our Jägers, with fixed bayonets, were already advancing from Miraumont, in the valley, against the farm, when our first shots fell there, doing great execution, as I myself saw a quarter of an hour later. I ordered the fire stopped and galloped ahead, to see the attack of the Jägers and to put in another battery there. Passing

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through Miraumont I stopped at an inn to get a glass of wine as a stirrup-cup. As I took out my purse to pay the young man, who had very cheerfully handed me the wine out of a window, a hostile shell came from some unknown direction, passed close to me, and tore the young man to pieces. The upper part of his body fell out of the window into the street—a horrible sight, not easily forgotten.

I rode on into the farm, and found it already in the possession of our Jägers, who were disarming some fifty territorials and taking away their one machine gun. The old chaps seemed pleased to get off so easily, and were making no resistance. The damage done by our few shells had had its effect upon them; a barn was burning, and in the dwelling house one shell had struck the front wall, and one fallen in the kitchen. The few inhabitants, who had just been getting their breakfast, were standing about pale and trembling, although fortunately none had been hurt. There were some wounded men in the cellar, which I at once searched, with a few men, to remove weapons and prevent any further resistance. Things looked bad enough there. The captain of the company that had been in Pys lay there on a mattress, shot through the body; he handed me his sword, and asked for mercy. He was an old, gray-haired man, a wine merchant from Paris; beside him lay his first sergeant, another elderly man, a notary, with a gunshot wound in the leg. I took from him a revolver, an old model that must have seen service in the war of '70; both these trophies I took with me. We did what we could to relieve the sufferings of the wounded, and sent a surgeon as soon as possible. The prisoners placed themselves under my protection, and, before being sent to the rear, asked permission to send letters home, which was gladly granted. I collected the letters and took them along, for which the prisoners expressed themselves as very thankful. Whether these ever reached their addresses I very much doubt; our field postal service was very good, but could hardly be held responsible if they were not delivered. One facetious Jäger suggested, in his homely Thuringian dialect, that someone might run after the rest of the French and give them the letters, so that they would get through quicker! Thus showing that our division still retained its sense of humor, as I have often had occasion to observe, even in the most dangerous situations.

Meanwhile my 2nd Battery had gone down to Miraumont, and was going into position near the churchyard—a place which previous experience ought to have taught us to avoid. Four weeks earlier, on August 26th, we had seen what happened to our sister battalion, the 12th, with the Saxon cavalry division, in the battles before Epinal; it went into action carelessly near the churchyard at Domptail, and suffered very heavy losses in a few minutes. Such conspicuous points ought always to be avoided, even in masked positions. To-day, September 28th, almost the same thing happened to us.

Being detained at Beauregard Farm, I arrived too late to change the battery position. It was fully masked, but hardly had it opened fire upon the hostile columns, which were still in full retreat, when a hail of shells fell upon it, forcing the men to take cover and interrupting the fire for a long time. As I personally noted, it was

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impossible for the enemy to see the flashes of the guns; and at this period of the war no one was using any system of flash or sound-ranging. It was another case of his excellent intelligence service. It is possible that the undergound telephone system was still intact, since the war had not reached this neighbourhood before; if, as we had often found, there were hostile artillery observers left in the village, disguised or merely concealed, they would have had no difficulty in directing their fire from a position, so to speak, behind our backs.

I have mentioned this subject in previous papers; and everyone in my battalion, especially those who may see these lines, will testify to the correctness of the statements. After this, we avoided churchyards, which we had no difficulty in doing, since in this rapid manœuvre we generally had all the room we wanted. Such a position facilitates the burial of the dead, but this seems hardly a sufficient reason for placing the troops in jeopardy. If, as is possible, the fire in this case was conducted from some other advanced position, which must necessarily have been far out on our flank, the observers did their work splendidly. Perhaps both methods were habitually used simultaneously. In any case, I have no hesitation in repeating here that the enemy's artillery observation and conduct of fire were of a very high grade; at the same time, of course, one should not forget the advantage that they had in fighting in their own country.

On the evening of this memorable day we were assigned quarters in Le Barcq, a few kilometres southwest of Bapaume, which was finally and definitely in our hands. Our trains, left behind at Gueuedecourt, had had a hard time of it; numerous hostile aeroplanes had taken them as a target, for on account of the size of their bivouac it had been hard to conceal it. The bombs began to fall just as the wagons had been parked, teams secured, and forage was being issued, and we lost many of our best men and horses. From this time on, we were never safe from these birds, and we had to develop entirely new methods of marching.

In this day's bombardment a bomb fell close to the stable sergeant of my 2nd Battery, and killed several men; the sergeant was so badly wounded that he was not expected to live more than a few hours. He was fully conscious, and understood his condition thoroughly. Although in great pain, he kept his self control, and set a splendid example, showing that the sense of duty of the good old army was still alive. Unable to move, he asked the train commander to take some letters out of his pocket and send them to the post office; his battery commander had given them to him that morning, with strict orders to send them at once. Since he was to die, he wanted to carry out his last orders! The skill and care of our surgeons finally saved the life of this brave sergeant, although he was badly crippled; and it was my pleasant duty to obtain the Iron Cross for him.

The enemy being so near and the situation so obscure, the troops were ordered to be in readiness for instant service during the night, and local guard duty received special attention. Our cavalry

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division covered so much ground that distribution of orders was very slow and difficult; besides, if often took all night to make the dispositions for the morning. Consequently, we generally received at night only orders as to time and place of assembly in the morning. In my battalion I insisted strongly upon punctuality, and admitted no excuses for any avoidable delay. The result was that we were in excellent standing at division headquarters, and the division commander, who was always on time himself, did not fail to express his appreciation. I have always found that a little praise at the right time does more good to the troops than eternal fault-finding.

On the morning of the 29th we were fighting near Achiet-le-Grand, on the railway from Albert to Arras, spread out on a broad front and engaging strong hostile forces which were just arriving. We had fine targets at 6000 metres, but could not reach them, and had to wait until the enemy came within better range, when he generally disappeared. A good long-range gun and an accurate rangefinder, and plenty of ammunition at hand for instant use, and we could have done great execution. As it was, my men were constantly digging trenches to sink the trails, which cost an enormous amount of labour, since we changed positions so frequently. I established an observation station for myself in the church tower at Bihucourt; in so doing, I may say, we did not make the amateur's mistake of opening the windows to show the enemy that there was someone there. We cut holes in the shutters, and masked all other openings. These precautions become a matter of course later, but many of our young cavalry officers had not yet learned the lesson then.

Further ahead, in Achiet-le-Grand, there was an incident that probably was due to this same sort of carelessness. A squadron of the 15th Dragoons had entered the town, and was to reconnoitre toward Achiet-le-Petit, which was still occupied, and which was only about two kilometres from my station. The squadron commander went up to the church tower, and must have attracted the enemy's attention; for when he came down to give orders for establishing a telephone line there, two shells burst with surprising accuracy at the foot of the tower, and killed the captain himself as well as several men and horses.

We could not push any further west, in spite of the constantly repeated orders from above to get into the enemy's rear and roll him up. As was illustrated later at Lens, the higher commanders very readily fell into the error of thinking that we could push the wall down with our heads; that the enemy would let a few weak cavalry regiments drive him back, just at the time when he was putting forth his whole strength and bringing in fresh troops to stop us. Whenever we came upon regular hostile infantry, we were generally stopped, for our cavalry did not like to advance with nothing but carbines. It generally came to a standing fire fight and cannonade against infantry, and against artillery too, when it was encountered. It was all little incidents of the great "race to the sea," as Stegeman so aptly called the general strategic situation. Here and there our enterprising cavalry brigades would gain a little

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ground westward, but generally could not hold it; we would go into quarters for the night, and in the morning find the enemy in villages where our men had been the night before.

Late in the evening of the 29th, we got orders to send a squadron of the 15th Dragoons and a few Hussars to occupy Gomiecourt, which was reported by patrols to be clear of the enemy. One of my batteries was to support the dismounted advance. The cavalry, assisted by a platoon of Jägers, got into the edge of the town, and things seemed to be quiet for the night.

At dusk we were assembled for orders in Sapignies, on the Bapaume-Arras road. General von der Marwitz, the army cavalry commander, was with us as a guest. He and his chief of staff were both "pushers," and added a little emphasis to every order for advance that came from above. Out of regard for my tired horses I had asked for special consideration for my battalion that night; and the division commander, who was always very approachable, had consented. I now asked for quarters near at hand, even if they had to be pretty well to the front. He asked if I would take the responsibility of remaining here in Sapignies and Behagnies, covered by two companies of Jägers. I answered at once, "Certainly; I feel perfectly safe up here with the Jägers, even if the enemy is so close." I told my staff triumphantly that we might take quarters right where we were, in the nearest buildings; the cavalry received orders for evening marches as long as 15 kilometres. We were perfectly happy; we felt that we could make ourselves safe and comfortable under the protection of the Jägers, and rest as in Abraham's bosom. The cavalry looked with envy at my billeting parties beginning their work; for however fine a fight one may have had, and however cheerfully he has died for his country, comfortable quarters for the night are not to be despised. But man proposes——! Suddenly a wild fusillade broke out in Gomiecourt, and showed no signs of moderating. A few dragoons came back on the run, and said that the enemy had attacked the two squadrons and almost wiped out one of them, and that fierce street fighting was going on. From the noise, this seemed very probable. Then the hostile artillery fired a few shells into the village, so as to endanger their own troops if such a fight was really going on. This did not seem reasonable; but still such things do happen, in spite of the regulations about co-operation between infantry and artillery. The situation was certainly obscure; it might be serious, or it might not. But in any case, I was worried about my convenient quarters in Sapignies and Behagnies; for we were pretty sure to get a change; I seemed to hear the voice of the General Staff officer, "The artillery must get back, of course."

And so it was. Instead of staying where we were, we had to march back, 15 kilometres in rear of Bapaume. We were given quarters in Beaumetz-les-Cambrai, for all the places farther forward were occupied by the 14th Reserve Corps. So after all we had our usual luck; the cavalry opening the way for the infantry, and then after a hard day's work marching far to the rear for quarters. But the worst thing about this march was, that it was entirely un-

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necessary. We learned the next morning that the report about the squadron of dragoons had been grossly exaggerated; the loss was only a few men, and after the evening shooting match the enemy had left the village entirely, while we had done the same thing—an incident not unusual in military history. The whole thing only goes to show what small causes may have large results, if one accepts a single unsupported report and acts upon it.

The next morning we were expecting to remain where we were. But during the night we got another alarm, and had to march at once. Our neighbouring division, the Guard Cavalry, sent word to us that it was surrounded in the villages just north of those we have been speaking of; and that there might be a catastrophe if someone could not cut them out. All the orders were sent accordingly; and we looked for another big day, saving a whole division from an overwhelming enemy. But when we reached our assembly point near Bapaume, the ghost was laid again, and our gloomy forebodings as to the fate of the Guard were dissipated; an officer from the Potsdam Hussars rode in, and informed us that the situation was improved, and that the Guard had got out of its difficulties. We could get nothing more definite, and the whole thing seemed to have been a false alarm.

Since we still knew nothing about Gomiecourt, and since I had orders to take position there or thereabouts, I decided to take my staff and make a reconnaissance in force; we wanted to see for ourselves, for we were losing confidence in the reports of the dragoons. Since we had to pass over open country, and did not want to be recognized as an artillery reconnaissance party, we borrowed from one of the squadrons a lot of captured French lances, which are of wood, very light, and shorter than our tubular steel shafts. I gave one of these to each of my party, officers and men, took one myself, and we rode out in small groups, two or three together, by different routes, toward the village marked with the question-mark. No shots were fired; and we soon succeeded in entering the village from different sides, supported by a few Uhlans. Then my lancer patrols galloped back to the division headquarters at Sapignies and reported Gomiecourt clear of the enemy—and got praise for our enterprise, and blame for our foolhardiness.

This is not the time or the place to describe all the firing positions that we took, during these days of desultory fighting over a wide area. We did not do so very much firing; there were plenty of targets, but it was clear that the enemy's attacks were not serious —that he was thinking less of gaining ground than of holding us back, while the fighting was heavy about the important road centre of Albert, farther south. We could generally tell early in the day whether our own force, like the enemy's, intended a mere demonstration, or planned a serious attack. In the former case we generally had infantry or Jägers with us; in the latter, the cavalry had to play a lone hand, while the artillery assigned to it observed the field and fired as required. The necessary mobility did not always suit us, for the Drill Regulations are right in saying that "every change of position reduces the fire effect."

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October 1st was our last day of fighting in this country, which afterwards suffered so much in the Somme operations of 1916. What the later years of the war did to this beautiful country is well known from the pictures in the war histories of the different regiments that fought there, especially the photographs of the 26th (1st Würtemberg) Division. The ground is entirely unrecognizable; only the ruins of a church tower here and there remain to mark the localities.

North of us there was fighting about Arras, which was too hard a nut for us to crack, and which, like Verdun, Nancy, Epinal, Amiens, etc., held out to the end of the war. Even in the great offensive of 1918 we could not take this important place, which had gradually grown into a fortress. The French will always take a special pride in its defence; like Ypres, it was shot to bits, but its luck seemed to hold nevertheless.

At this time, the end of September and the first of October, it was the Guard that was trying to rush the place, making costly attacks strongly supported by artillery; only to find out, however, that the most determined attacks by the best of troops must fail if met by equally determined and well-prepared defence. On October 1st—a bright, clear day, just the thing for the enemy's airplanes—we were in action near Courcelles-le-Comte and Ervillers, on the railway between Achiet-le-Petit and Arras. The first planes of the day were greeted by wild bursts of carbine fire from some of the cavalry squadrons; this sort of shooting never did any good, and was soon forbidden by the division, for the planes flew too high. They were dropping bundles of arrows, but made few hits. Those that did hit were dangerous, however; I saw one that had penetrated a saddle and gone so deep into the horse's back that it was removed only with great difficulty; and men hit in the head were generally killed.

For a whole week we had been fighting to hold Bapaume, and had had many interesting experiences. We had done a good deal of marching, and had learned much about artillery which proved valuable later. We had developed our observation system greatly; had secured more and more wire, and a few additional instruments, chiefly from our excellent information sector. We had to observe such large areas, and the enemy scattered his infantry about so thinly that the targets were generally unimportant and at long range; we thus came to appreciate the value of plenty of observation stations, even though it did cost a great deal of labour to establish and move them. Napoleon says, of the commencement of a battle, "On s'engage partout et puis on voit." Nowadays in the artillery we should prefer to reverse this process—see first, and then decide when there is a target worth while. This should always be the guiding principle of the artillery; not the idea that became so popular with many during the war, of shooting whether there was a target or not. One who has to count rounds of ammunition cannot afford this luxury; besides, the infantry soon loses confidence when it finds out that the artillery is shooting at random and not performing its real duty.

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I have always opposed shooting at a whole landscape because there might be some of the enemy there; I prefer not to open fire until one has some sort of idea where he really is. But this was very hard to find out in 1914, for we had very few airplanes; especially were we deficient in artillery observation planes, which we later had in abundance.

On October 2nd our division got together, for the first time, in a march column on one road. It was much smaller than when we took the field, with 7,000 horses; still it was an impressive mass, and had acquired one new cavalry regiment, the 16th Uhlans. We assembled at Vaux-Vraucourt, northeast of Bapaume, and started at a free trot, leaving Arras on our left, northward towards Douai, in search of new adventures.

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CO-OPERATION BETWEEN INFANTRY AND ARTILLERY IN HILL WARFARE.

BY MAJOR R. N. L. DUTTON, O.B.E., M.C., R.A.

THE problem of good co-operation between infantry and artillery in hill warfare particularly on the North-West Frontier of India, is one that has vexed a great many gunners.

The following is a method which has been actually frequently used in the Waziristan operations with successful results.

A picquet commander or commander of a party of infantry sees a target which he wishes the artillery to engage. He can see an artillery heliograph or knows the position of a certain part of the Artillery. He gets into communication with their helio or with the portion of artillery of which he knows the position and indicates the target he wishes to be engaged.

In order to do this he imagines himself as being the centre of a clock face of which the known portion of artillery is 6 o'clock.

His method of indication is :—

1st. He gives the call of the portion of artillery he wishes to call up. i.e., C.R.A's call or a special battery call, etc.

2nd. He gives his own call. (If he is not in visual communication this is very important).

3rd. He gives the position of the target in clock code spelling out the time, i.e., if target is at one o'clock, he sends ONE.

4th. He gives the distance of the target from himself in yards in figures to the nearest hundred of yards; i.e., if the target is 400 yards away from him he sends 400.

5th. He gives the approximate relative height of the target above or below himself in feet prefixing this height with P L if above or M N if below.

The height in feet in given in figures; i.e., if target is estimated as 50 feet above him he sends P L 50.

As will be seen every group of figures is separated from any other group by a word or letter, so there is no danger of groups running one into another.

Taking the above example, supposing the battery call to be B C E and the picquet call to be W C H, the message would read as follows :—

B C E
W C H
ONE 400 P L 50

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The message is as brief as possible. Number of words, break, signs, etc., are not sent.

If this message is sent to the C.R.A., he will allot the target to a battery or section who will have to plot out the position of the target. If however the picquet commander is in direct communication with a battery the latter's procedure is very simple.

As soon as a battery starts getting such a message from a picquet it lays out a zero line on the helio of the picquet and takes the range to the picquet and measures its angle of sight. The B.C. then uses his aeroplane dial card to get the switch and range to the target.

Let us suppose that he receives a message TWO 300 and that the range of the picquet is 3500. His switch would be 4° 30′ more right and the range to the target would be 3650. Angle of sight of course presents no difficulties. The ⋀ (12 o'clock of the dial) is of course set at 360°.

The B.C. then sets his aeroplane dial card by placing the ⋀ 60° to the right of 360° i.e., where two o'clock is when the ⋀ is at 360° and is ready to make corrections on the receipt of observations.

When he is ready to fire he sends L.

The picquet commander in order to give his observations of the fall of rounds imagines the target to be the centre of a clock face of which his own position is 6 o'clock and sends them as previously he had sent the position of the target i.e., he spells out the o'clock and gives the distance of the fall of the shot from the target in figures. In making his observations, if the shot falls over 100 yards away from the target he sends the nearest hundred of yards; if within 100 yards to the nearest 50. For instance, if he judges the shot fell 220 yards away from the target, he sends 200; if 80 yards away 100; if 30 yards 50; if 20 he sends O.K.

The battery does single gun ranging and uses H.E. or percussion shrapnel. When an O.K. is sent or the B.C. is satisfied he fires a salvo. In the latter case first sending the picquet commander letter V.

When a salvo is fired the picquet commander observes the M.P.I. of the salvo and sends M (mostly) corrections. For instance if a salvo is fired of which he judges the M.P.I. to be three o'clock 50 yards he sends M THREE 50.

When the target has dispersed, which usually happens pretty quickly on the frontier, or if the picquet commander wishes the battery to stop firing he sends M T (empty guns).

If at any time during the shoot the B.C. spots the target and wishes to carry on with his own observations he sends C O (I can see the target and am engaging it with my own observation). When a picquet commander receives a "C O" he only sends M corrections.

Such is the scheme. Now a few words as to how I got infantry officers and men interested and proficient in it.

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Whenever we came across a new regiment I got the Colonel to let me lecture to his officers on a sand model. They then explained the system to their men and a few selected Indian Officers and N.C.O's were sent to me for instruction on the sand model. When they had been to me half a dozen times they were turned on to instruct the remainder of the battalion.

Round discs marked as clock faces help backward pupils very considerably.

I found that most Indian Officers and N.C.O's with very little practice could estimate their observations to half hours. In a short time they became most enthusiastic and in actual shows the system has worked most awfully well.

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"SPORT."

Its uses and abuses as an adjunct to the training of the Soldier.

(Prize Essay.)

BY CAPTAIN P. I. NEWTON, D.S.O., R.G.A.

WHAT are the attributes of an efficient army? Apart from its equipment, which does not enter into the subject of this essay, I imagine that if every man is physically and morally fit for his job, able and anxious to take on the next higher, if all ranks are contented and working happily together; then the desired result is well on its way towards achievement. These are platitudes I fear, and I am afraid there are more to follow.

The first consideration, is to keep every individual in good physical condition, and to do it in the pleasantest and least irksome way we can devise.

The second, and to my mind the more important, is to bind all these individuals together, and to get them working harmoniously for a common end.

The simplest way to do this, will be to give them a common interest; and the interest that naturally suggests itself is the military unit to which they happen to belong.

As I shall argue later on, the 'self conceit,' if I may use such an expression, of any unit varies directly with the number of competitions it is able to win. There are other influences of course, but they do not affect the truth of the last statement.

With regard to my first consideration. Some men are naturally keen on their own physical well being, but the majority require some incentive to enable them to overcome their constitutional laziness. This can be provided by means of individual interests; but better, I think, by arousing a mans enthusiasm for his own unit; consequently it is to the unit that most attention must be directed. At the same time, the man himself must not be neglected.

It is not desirable to suppress his individuality; very much the reverse, because his initiative will probably be suppressed at the same time, but each man, in addition to being fit himself, must be taught to take his part in the whole. What I am about to examine is how far sport and games can be made to assist in the process.

Sport and Games can fufil three functions.

1. They develop the physique and character of those who take part in them.
2. They provide recreation, and an occupation for leisure hours

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3. They provide a common ground on which all ranks can meet as equals.

It is commonly agreed that it is better for a subaltern in India to spend his leave shooting in Kashmir or the Central Provinces, than in wasting his money in hotels at a hill station; and on consideration it is clear that this must be so. I am not attempting to decry the merits of mixed tennis or dancing, taken in moderation, but a man who will voluntarily spend two months in the jungle at the beginning of the hot weather, must surely be better material of which to make a soldier, than he who only studies his own comfort and ease: and I think that the men in one's battery, who turn out regularly to games, are better in the main, than those who have no soul above the "pictures."

I want to consider Sports and Games under three headings:—

1. Regimental and Battery Games, in which officers and men can play together.
2. Individual Sports, i.e. those which do not involve a team.
3. Military Sports, such as Assaults-at-Arms, Rifle Meetings; and the introduction of the element of sport into ordinary work.

1. Regimental and Battery Games.

I once heard a remark about a certain Battery Commander in India "X must be a pretty good man. Not only did his battery get a "Special" at practice, but they also won those two cups, (referring to "the Punjab R.A. Hockey Cup and a Cup won in some minor football tournament) and no bad battery could ever win anything."

There is no doubt in my mind as to the value to a unit of possessing a first class team at football, hockey, tug-of-war, or anything else.

It forms a bond between officers and men, and its effect on *esprit de corps* is remarkable. There is at once something tangible that everyone can get hold of and be proud of.

In war time there are the general record and traditions of the unit, but in times of peace, a reputation for—good conduct, say,—is not nearly so precious as the possession of this or that Cup. To realise the truth of this, one has only to note the difference in the number of men who turn out to watch their team play, when they are expected to win, and when it is well known that they have not a chance. And once a unit has a good side, it is very apt to keep it. One has heard of so many, who year after year excel at some particular game, although it cannot be supposed that the same men are available all the time. I could give many instances of this, but two will suffice. At one time a certain Irish Regiment could hardly be beaten at hockey in the North of India, in fact I doubt if they were beaten, up to the time they left the neighbourhood, while the prowess of a certain Mountain Battery at tug-of-war was known all over India for many years.

It is interesting to note that this battery still had a very fine team in 1918. Both these units were proud of their achievements and both

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were first class in every way. I think therefore that it will be agreed that it is important to have your unit good at games. Not only is the moral effect great, but the spirit of emulation will make more men turn out, to the consequent improvement of their physique and to the development of their characters which is universally admitted to be one of the best results of playing in 'team games.'

How can we best get a good football team in our battery? Not (as I have known happen) by persuading likely men in other units, to transfer, but by getting as many men as possible to play, by the officers turning out themselves, and by encouraging every man to come and watch the team when it is playing in a competition.

Ought it to be compulsory for every man to play in battery games? There is no doubt at all about the subalterns. They ought all to be compelled to play at least one kind of game with their men. The Captain too, unless he is very aged. There is no better way of getting to know the men, and of winning their respect and regard. Even though an officer be a perfectly futile performer, he will be respected the more for trying. About the men I am not so sure.

Personally I consider games quite as important as education, or starting the morning with "Physical Jerks" but I think there may be objections to compulsion as one would not compel officers to play games which are played by officers only. But they should all be very strongly encouraged, and efforts should be made to find the natural bent of each man and to give him an opportunity of exercising it.

I shall have more to say on this subject under the heading of individual sports, but meanwhile I would urge the necessity of arranging battery games in such a way as to take in as many as possible.

Many methods occur to one at once. Sub-Section tournaments, six-a-side, etc., with always the idea being fostered that it is an honour to represent the unit, and that that should be every mans ambition.

I have often wondered whether some system of "Colours" such as we strive for at school, could be introduced with success. So many given every year, and no one else allowed to wear them. I have never seen it tried, but I think it might work, if it became a more or less universal practice.

One more point before I turn to my second heading. Officers are constantly being urged to take an interest in their men's amusements, but are the men ever encouraged to do the same for their officers.

And yet it would be an excellent thing if they were. How many of our men, for instance, know or care about the result of the Annual R.A. & R.E. Cricket Match? I do not suggest that they should be invited to come and watch Subaltern Smith and Mrs. Snooks win the handicap mixed doubles at the Club, but I am sure that Subaltern Jones would be pleased if his section turned out to cheer him as he flogged his pony home in the Bumblepore Stakes; and not less would the Regimental Polo team be encouraged by the presence of the bulk of their men to watch their efforts in the final of the Station Tournament. Anything that tends to improve relations and increase the sympathy

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between officers and men is good, so perhaps this is worth consideration.

2. Individual Sports.

It will hardly be necessary to detail a list of the advantages to be derived from indulging in what, for want of a better name, I call "Individual Sports." Physical fitness, endurance, eye for country, Ability to make a "bandobast" are a few of them : and the fact that the advantages are so numerous, should be a sufficient reason for encouraging everyone to take part in these sports.

This is pretty easy as far as officers are concerned, especially in India, where opportunities are many and varied, leave comparatively easily come by, and expense not prohibitive.

I am not in favour of taking the strong line of refusing leave to all who do not show signs of spending it in a suitable manner; but here we may at least employ propaganda, and it is here that the general tone of the Mess will have a paramount influence.

One often hears such remarks as "The such and such battery, "or they are a good sporting lot; have you seen their Mess? Stiff with "heads! They run a battery polo team too" or "The this and thats. "They are not much good, there is only so and so who ever does a thing." And it is usual to find that the efficiency and general well being of the "Such and suchs" is far in advance of that of the "This and thats." Further, that young officers joining will be apt to take their tone from that prevailing, for it is difficult for a youngster to strike out a line for himself, especially where a shooting trip is concerned, with none to encourage or advise him. What may be the effect of such advice as the following on the unsophisticated mind of the last joined subaltern. "Kashmir, yes easily do it on your pay if you don't try and do yourself too well, I'll tell you where to go" or "Kashmir! my dear chap, don't touch it, frightfully expensive, awful sweat; and d—d lonely."

This last of course from one who has not been and who never intends to go.

But turn now to the care of the men. Here is a much harder problem. What have they for their exercise and recreation outside battery games, etc., which excellent as they are, cannot be played solo.

Is it possible for the men to amuse themselves in the same ways as their officers do, and if so, is it desirable? What it amounts to is this. Are we content with the type of men we have always had for soldiers, or do we want to change them for something else, presumably better, and more—well—up-to-date? The man we have always known had certain well-defined characteristics. He was not prone to show much enthusiasm or even gratitude; yet very like a child, helpless to run anything for himself, he was very dependent on his officers, whom he recognised as his natural leaders and was prepared to follow anywhere. But I do not think we need worry ourselves. The men are changing, and will change, without our help, and the best we can do is to see that they change in the right direction.

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Such changes as have shown themselves so far among the people generally, are not very promising, and are mostly in the nature of a clamour on the part of inferiors that they are the equals of their betters, without any real attempt on their own part to improve themselves. It seems to me that sport and games can afford very valuable assistance in leading these tendencies in the right way. If we can get men to see the virtue in giving something for nothing, and in doing things for the mere joy of doing them, instead of looking for reward, usually monetary, for everything they undertake, we shall have achieved much. At present we are busily engaged in educating our men, and with increased learning must come a change in tastes, a desire for higher and more varied forms of recreation than have been available up to now.

An army in which all men are equal is obviously impossible, but I think that to maintain the superiority of the officer, and with it his authority and power of leadership, will be better accomplished by improving him, than by trying to keep the men back. Further, any such reactionary attempt would certainly lead to discontent and its attendant evils. Another point is, that the men have more money than they had, and may not always be content to spend it in the canteen or at the cinema. Besides, I have already argued that "pictures" do not represent that best possible assistance to training which we want sport and games to provide.

All this is leading up to my contention that some improvement must be made in the facilities at present offered to the men for employing their leisure.

Well then, what is to be done about it? A great deal has been done already, has been done for years in fact, in the way of gymnasiums, boxing, swimming baths, athletics, etc.; and it is impossible to lay down fixed rules as to what more can be done. The resources of each individual station will do that for us. There is not room for everyone to go shooting, even in India, and I do not expect many M's.F.H. would welcome an addition to their Fields of a hundred or more N.C.O's and men mounted on Battery horses.

But some can go and ought to be encouraged to. Of course they can already get shooting of a sort in India, but the shooting pass restrictions are most irksome, and none of the best ground is open to the rank and file. These sports should be made a privilege for a limited number of carefully selected men, and restrictions modified if they cannot be abolished altogether.

Suppose tennis courts were provided, would the men use them? Probably not. I must admit that I cannot picture them, having seen the efforts of the average sergeant in this direction. But if they were taught and encouraged, there is no knowing what the result might be. Handball is already a favourite game, and the provision of properly covered and lighted fives courts for use in winter would not cost a great deal. Some stations at home have Regimental Golf Links. Why should not the men play golf; and the enthusiasts could help to keep

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the course in order. The sea is open to all who are stationed by it, and the provision of boats for sailing, sea-fishing, etc. would probably be a great success. These are a few suggestions: most have already been tried somewhere or other, but they want extending and making more general. I have already mentioned that the men have more money than they had. Well they must be encouraged to spend it on their sports, far more than they do, and not get into the way of thinking that everything should be provided free. They will be all the keener on anything in which they have also a financial interest.

It may be urged that it would be bad for discipline to let the men get too independent, and that they should depend on their officers for their sport as much as they do for everything else.

It is not the independence derived from indulging in sport, that will do any harm; and the fact that the men are being encouraged to go in for individual amusements need not preclude the officers from taking an interest, and from giving advice and help.

3. Military Sports—and the introduction of the element of sport into work.

There remains the subject of Military Sports, Assaults at Arms, Rifle Meetings, etc.

Of these there is little to say. They have all the moral advantages of Regimental Games, with the additional ones of providing an incentive to proficiency with arms. They should be held frequently in all areas, and I am in favour of always including in Regimental Athletic Sports Meetings, a few events of military character.

ABUSES OF SPORT.

By far the greater part of this essay has been devoted to the uses of sport, and that is natural, for of sport and games used in the right way there is nothing but good to be said. But it is not possible to close without reference to a few abuses which are apt to creep in, one or two of which indeed are common, and which ought to be carefully watched for and eradicated at once.

The first is a tendency to make games the end instead of the means. By all means give men leave to play in specific matches, but it is a wrong principle to strike a team off duty for training purposes. It is frequently done, and the O.C. who refuses to conform to this custom, sometimes has the mortification of finding his men refusing to form a team. Nothing could be worse, and to encourage such an attitude is to encourage all the worst traits which unfortunately exist in the character of our soldiers.

It savours of professionalism, and after all the men are paid to soldier, not to play football.

Moreover in ordinary times they have plenty of leisure, and there is no need for it. The same applies also to officers, though not quite in the same way. No one will quarrel with an officer for trying to get to a station which provides him with his favourite amusement, so long as he does not neglect everything else for its sake.

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But there are people who seem to be always away on leave, and although one admires and envies these, one questions whether their continued absence is for the good, either of themselves or of their unit, especially when one has to do their duty for them.

There is another aspect of the case of officers. While those who are good at games are rightly in considerable demand, it should not be possible for a man to step from one soft job into another, or worse still into some more or less important post with no other qualification for it. There is another custom common in Army games which I think comes under the heading of "Abuses."

It is that of giving money prizes, which also tends to foster that spirit of professionalism which we are so anxious to remove. I have heard of a case of Regimental Sports, fairly recently, where the events failed to fill, because in the opinion of the men, the prizes were not big enough. "Sport" does not mean the "chance of acquiring money" though many people seem to think it does.

There is only one way of dealing with this evil, and that is by abolishing money prizes altogether. It is no use quoting tags about "Sport for Sport's sake," and the "honour and glory of winning" so long as we encourage the cupidity of the competitors by offering them money.

To change this will take a long time, and first attempts are doomed to failure. But I am sure it could be done, and we should be a long step nearer the new type of soldier on whose virtues I have already enlarged.

One more possible abuse, and it is this. There is always the risk of stirring up inter-regimental, and more particularly inter-arm-jealousies over games. It is most common at Assaults at Arms, especially when there is a "best all round" cup or shield at stake. No necessity to impress on everyone the evil results of this. They are obvious. There will not be much cohesion in a Division whose artillery and infantry cannot get on together.

And it is not too easy to find a remedy. The best chance lies in the carefully thought-out fairness of the competitions. If it is thought necessary to have an "all-round shield" only events in which all have an equal chance should count towards it. If such jealousy should appear, in a competition in which there can be no question of one or other having an unfair advantage, such as a football tournament; it may be necessary to take the very strong line of preventing the guilty units competing with one another at all. Competition and rivalry are good, but jealousy is very bad.

To sum up. Sport and Games used in the right way, that is to say, free from the abuses which I have just mentioned, are very good; especially now-a-days when their well-known influence on mind and body can assist in counteracting the growth of Bolshevism in our midst. Their most important functions are to cement the relations between officers and men, and to give the latter an interest which will prevent them from becoming bored with soldiering. We have got to realise the

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changes that are taking place in our men, and we must be prepared to guide them in the right direction. Consequently, I have indulged in some rather fanciful suggestions, such for instance, as that of getting the men to play tennis. But surely it will be better to be ready for all eventualities, and I would rather see the men playing themselves, than cutting up their officers courts because they cannot see why their officers should play, while they do not.

While on this subject I will just mention the question of fatigues for the benefit of officers. I do not think they are sound. I am not really in favour of men employing men with payment on such work, though they often like it, and it does no particular harm. But I am inclined to the theory that no fighting man should ever be employed as a menial, even as a batman. Let him do his own dirty work by all means; but for servants, etc., I would far rather see some sort of Labour Corps formed of men enlisted solely for such purposes.

In conclusion. I have not entered into the details of the application of Sport to training, having preferred to deal with the wider aspect of the influences it exerts. And my reason is that I believe that if we keep everyone fit and everyone happy, the rest of the task will be easy.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—August, 1921.

I. Notes on Armoured Cars. (Continued). Cap. Comdt. Vander Donckt.

II. Gas Warfare. (Continued). Dr. de Sillevaerts.

III. Machines used by Railway Battalion for track laying. Maj. Verschueren.

IV. The Automatic Rifle.

V. The effect of the War on Artillery. (Continued). (Continuation of Gen. Pontus's lecture published in *Bulletin belge*, June and July).

Ch. IV. Lessons of the War.—Artillery Aviation—Liaison—Fire power—Support of Infantry—Value of cover—Importance of surprise and rapidity—Tactical and Strategic mobility—The Artillery General Reserve—The Command of the Artillery—Conclusion.

The lecturers remarks on Artillery aviation are interesting.—He cannot see why the Air Force should be separated from the Army, and considers that many counter battery tasks were spoilt by insufficient help from aviation.

He considers that regiments of Heavy Artillery (armed with guns) should have two air squadrons permanently—

(1) One for observation and reconnaissance

(2) One bombardment squadron.

The Heavy Artillery (Hows.) and Divnl. Artillery should have one squadron for observation only.

VI. Some ideas about Cavalry.

VII. Notes on Foreign Armies.

Germany.— (See *Journal*, March, 1921. Notes on Foreign Journals, p. 12.)

Execution of the Ultimatum of May 5.

(1). Number of Officers limited to 4,000.

(2). The Regiment "Wachtregiment Berlin" is disbanded.

(3). The Arsenals (depôts of Artillery and Train) are reduced to two.

(4). The Cavalry School of Soltau (branch of the Hanover School) and the Infantry School of Wunsdorf (branch of the Munich School) are done away with.

(5). Dissolution of Citizen Guard organizations. The Imperial Government has been forced to decree itself the disbandment of these.

It will take some time for the Inter-Allied Commission of Control to see that this is properly carried out.

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(6). An Imperial Decree of June 14th, urges all the States to modify their Police Organization to meet the requirements of the Commission of Control. Its a vague document giving little detail of how reductions are to be carried out.

German losses in the War. In a former number, estimated at 1,800,000 men; now 1,822,545. Of all the German States Würtemburg had the greatest percentage of losses, 73,500 dead out of total population of 2,600,000 i.e., 1 death to every 35 inhabitants.

Deliveries and destruction of arms to June 17th.

	Delivered.	Destroyed.
Guns and tubes	38,300	37,380
Trench mortars	10,800	10,210
Machine guns	81,400	72,100
Small arms	3,914,350	3,738,900

Of the seven guns of great range, 4 wore out during the war and were destroyed; the 3 others were destroyed after the Armistice (one of these burst undergoing trials).

France.

Revue Militaire Générale.—July, 1921.

I. The 2nd Cavalry Corps in Flanders. April 9—May 3, 1918. Col. R. Boullaire and Comdt. J. Brun.

II. Remodelling of Regulations and our War Teaching. III. Lucius.

III. The Staff Officer. (Lecture at Ecole Supérieure de la Marine). Naval Capt. Castex.

IV. Notices of New Books—Foreign Journals—Militär Wochenblatt, 15-22 Jan., 1921, contains an article by Inf. Gen. von Zwehl. "The break-through on the Macedonian Front, Sept. 1918."
Col. Kalafatovitch of the Serbian General Staff in the *Revue Militaire Générale*, July 1920, describes Franchet d'Esperey's offensive—von Zwehl disagrees with Kalafatovitch's view, and states that the primary cause of the collapse was the bad conduct of the Bulgars under fire.

In the same paper, 9th April 1921, General of Artillery von Scholtz writes on the same subject, also attributing the disastrous result, not to bad dispositions, but the absence of will to fight.

Revue d'Artillerie.—August, 1921.

I. The crisis in obtaining Officers for the Artillery. Col. Tournaire.

II. Employment of the French Artillery in defence in 1918. Maj. Goubard.

III. Different ways of assessing wages. Maj. Graux.

IV. Fire Tactics. (Continued). Col. Cambuzat.

V. Caterpillars. (Continued). With four very good photographs of Schneider and St. Chamond carriages.

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VI. German Firing Manual of 4th Dec. 1919. (Applicable to the Artillery—replaces the Manual of 1st Dec. 1917). This commences a series of articles partially translating the manual—only dealing with the main features and changes from the 1917 handbook.

VII. Miscellaneous News. Uniform of the Reichsheer is to be field gray of universal pattern. Each branch being distinguished by the colour of the lace on the collar and the edging of shoulder cords and caps.
Rank and file N.C.O's, rank on left arm. Under Officers on collar and shoulder strap.

Officers'. Rank is shown as follows :—

Epaulette in dull grey silver	2nd Lt. Lieut. 1 star. Capt. 2 stars.
Epaulette in plaited silver lace	Major. Lt.-Col. 1 star. Colonel 2 stars.
Epaulette plaited in silver and gold lace	Maj.-Gen. Lt.-Genl. 1 star. General 2 stars.

Switzerland.

Revue Militaire Suisse.—July, 1921.

I. An Infantry Captains rôle during the war. (Continued). Capt. Glasson.

II. The Franco-Swiss Military Agreement of 1917. Col. Feyler.

III. Notes on Military Bridges. Col. Lecomte.

IV. The Reichswehr—Its formation, its purpose and the actual organisation.
(Commences a series of articles by Maj. de Valliere which will be reviewed or translated later).

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REGIMENTAL LIST. The following Postings have occurred during the period 16th July, to 15th August, 1921.

Postings.—R.H. and R.F.A.

Agnew, Major K. M., D.S.O., M.C., from Adjt. 2nd (Lancs.) Army Bde., R.F.A., T.F., to Adjt. 59th (Home Counties) Bde., R.F.A., T.F. 15/8/21.

Allsup, Major E. S., D.S.O., from Bde. Maj. 50th (Northumbrian) Divn. T.F., to 90th Batty. Woolwich. 5/8/21.

Akroyd-Hunt, 2nd Lt. J. A., from Royal Military Academy, to 34th Bde., Brighton. 26/7/21.

Belgrave, Lt.-Col. J. D., D.S.O., from 52nd Batty. to 15th Bde., Bulford. 5/8/21.

Bonham, Lieut. J. E., from 4th Res. Bde., Woolwich, to Att. Headquarters, Irish Comd. 12/8/21.

Brinton, Lieut. E., M.C., M.M., from Att. D.A.P.M., Mesopotamia, to Att. 4th Res. Bde. 11/7/21.

Brownhill, Lieut. C. N., M.C., from A.-D.-C. to Maj.-Genl. Ironside, N. Persian Force, to Att. 4th Res. Bde. 8/7/21.

Burd, Lieut. J. M., M.C., from R.A.F., to Att. 5th Res. Bde., Woolwich. 1/8/21.

Butler, Lieut. A. E., from 11th Bde., Ipswich, to Att. Headquarters, Irish Comd. 12/8/21.

Carson, Lieut. T., M.C., from Att. R.A.O.C., Rhine, to 3rd Bde. R.F.A. (Rhine) Ammn. Col. 21/7/21.

Du Boulay, 2nd Lt. T. H., from Royal Military Academy, to 14th Bde., Colchester. 26/7/21.

Duncan, Capt. C. M., from 4th D.A.C., India, to 184th Batty, India. 26/6/21.

Fayle, Major D. B. W., M.C., from Adjt. 3rd (Lanark) Army Bde. R.F.A. T.F., to Adjt., 80th (Lowland) Bde., R.F.A., T.F. 15/ 8/21.

Flippance, Lieut. S., M.C., from 78th Batty. R.F.A., to Att. 4th Bde. R.H.A., Ireland. 3/8/21.

Fripp, 2nd Lt. A. E., from Royal Military Academy, to 69th Batty., Ewshott. 26/7/21.

Gathorne-Hardy, 2nd Lt. J. D. (Earl of Cranbrook) from Royal Military Academy, to 11th Bde. R.F.A., Ipswich. 26/7/21.

Giffard, Major J., O.B.E., from M.O.3. War Office, to Adjt., Berks & Bucks. Bde. R.F.A., T.F. 1/8/21.

Godfrey, 2nd Lt. A. F. H., from Royal Military Academy, to 3rd Bde., Rhine. 26/7/21.

Hancocks, Capt. A. C., M.C., from 131st Batty., to 10th Bde., Constantinople. 25/7/21.

Heslop, Lieut. W. T. B., from 17th Bde., to Adjt., 3rd D.A.C., India. 4/10/21.

Hodgson, Lieut. C. F., from 11th Bde., to G.H.Q. Ireland. 12/8/21.

Jelf, Lt.-Col. W. W., C.M.G., D.S.O., from Staff, to Superintendent, Riding Establishment, Weedon (R.H.A.) 14/8/21.

Knox-Peebles, 2nd Lt. W. C., from Royal Military Academy, to 11th Bde., Ipswich. 26/7/21.

Larden, 2nd Lt. G. H. N., from Royal Military Academy, to 11th Bde., Ipswich. 26/7/21.

Longfield, 2nd Lt. R. J., from Royal Military Academy, to 11th Bde., Ipswich. 26/7/21.

Meredew, Lieut. O. W., from 4th Res. Bde., to G.H.Q., Ireland. 12/8/21.

Neville, 2nd Lt. R. D., from Royal Military Academy, to 3rd Bde., Rhine. 26/7/21.

Nichols, Lieut. C. E., from 1st Res. Bde., to G.H.Q., Ireland. 12/8/21.

O'Sullivan, 2nd Lt. F. P. M., from Royal Military Academy, to 35th Bde., Bulford. 26/7/21.

Peter, 2nd Lt. G. A. C., M.C., from Royal Military Academy, to 14th Bde., Colchester. 26/7/21.

Phillips, 2nd Lt. H. C., from Royal Military Academy, to 14th Bde., Colchester, 26/7/21.

Smith, Lieut. L. C. L., from Staff Captain, Mesopotamia, to 22nd Batty., Brighton. 28/7/21.

Turnbull, 2nd Lt. D. J. T., from Royal Military Academy, to 8th Bde., Deepcut. 26/7/21.

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Postings, R.H. & R.F.A.—*Continued.*

Way, 2nd Lieut. A. B. M., from Royal Military Academy, to 12th Bde., Aldershot. 26/7/21.
Weigall, Lieut. E. T., from 9th Bde., to G.H.Q., Ireland. 12/8/21.
Wynter, 2nd Lieut. D. E. H., from Royal Military Academy, to 49th Batty., Aldershot. 26/7/21.
Whiting, Lieut. H. J., M.C., from Royal Air Force, to 81st Batty. Bordon. 1/8/21.

Postings.—Royal Garrison Artillery.

Barrett, Capt. G., from H.Q. & D.E., R.G.A. Portsmouth, to G.H.Q., Ireland. 12/8/21.
Beattie, Capt. A. J., M.C., M.B.E., from R.G.A., Harwich, to G.H.Q., Ireland. 12/8/21.
Bedbrook, Lieut. H., from H.Q. & D.E. R.G.A., Tees & Tyne, to G.H.Q., Ireland. 12/8/21.
Beville, 2nd Lt. C. H., from Royal Military Academy to 9th Bde., Bordon. 26/7/21.
Bignell, Capt. R. G., from D.A.Q.M.G., Aden, to unposted list. 6/6/21.
Bromley-Kemp, 2nd Lt. A. L., from Royal Military Academy, to 9th Bde., Bordon. 26/7/21.
Burges, Capt. W., M.C., from H.Q. & D.E. R.G.A., Thames & Medway, to G.H.Q., Ireland. 12/8/21.
Cassidy, Lieut. D. M., M.C., from Att. R.A.F., to "G" Coast Batty., Portsmouth. 1/8/21.
Chesney, 2nd Lt. M. J. P., from Royal Military Academy, to 29th Batty., Rhine. 26/7/21.
Collier, 2nd Lt. R. D. T., from Royal Military Academy, to 10th Bde., Larkhill. 26/7/21.
Crawford, 2nd Lt. J. H. L., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Crouch, Lieut. J. A., from H.Q. & D.E. R.G.A., Thames & Medway, to G.H.Q., Ireland. 12/8/21.
Davidson, Lieut. A., M.M., from H.Q. & D.E. R.G.A., Milford Haven & Severn, to G.H.Q., Ireland. 12/8/21.
Dean, Capt. W. T., M.B.E., from Att. H.Q. & D.E. R.G.A., Plymouth, to "I" Coast Batty., Plymouth. 4/8/21.
Dobbin, 2nd Lt. R. W., from Royal Military Academy, to 3rd Batty., Gibraltar. 26/7/21.
Dowman, Lieut. J. P. G., from 5th P.A. Bde., A.C., to 15th P.A. Batty., Palestine. 10/8/21.
Drake-Brockman, Capt. W. H. G., M.C., from Att. Officer, M.I. War Office, to "K" Coast Batty., Dover. 19/7/21.
Eyre, 2nd Lt. F. C., from Royal Military Academy, to 10th Bde., Larkhill. 26/7/21.
Firbank, 2nd Lt. L. T., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Fry, Lieut. A. E., M.C., from 29th Batty. R.G.A., Rhine, to Att. R.A.O.C., Rhine. 21/7/21.
Gillam, Lieut. J. F., from H.Q. & D.E. R.G.A., Portsmouth, to G.H.Q., Ireland 12/8/21.
Gilpin, Capt. W. J., M.C., from 4th Bde., to G.H.Q., Ireland. 12/8/21.
Goodwin, Lieut. E. A., from 8th Bde., to G.H.Q., Ireland. 12/8/21.
Grant, Capt. W., from Att. R.A.O.C., Alexandria, to "B" Coast Batty., Gullane. 1/8/21.
Greene, Lt.-Col. A. C. R., from unposted list, to P.A. Depôt, India. 29/7/21.
Greig, 2nd Lt. R. B., from Royal Military Academy, to 9th Bde., Bordon. 26/7/21.
Harler, Lieut. F. C., H.Q. & D.E. R.G.A., Portsmouth, to G.H.Q., Ireland. 12/8/21.
Haslewood, 2nd Lt. W. G., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Hall, 2nd Lt. H. L. C., from Royal Military Academy, to 10th Bde., Larkhill. 26/7/21.
Hayes, 2nd Lt. H. A., from Royal Military Academy, to 8th Bde., Exeter. 26/7/21.
Hayes-Sadler, Major J., from 9th Pack Bde., to unposted list. 29/7/21.
Hooper, 2nd Lt. W. H., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Jeyes, Lieut. S. R. J., from 8th Bde., to G.H.Q., Ireland. 12/8/21.
Jones, Lieut. C. W. F., from 8th Bde., to G.H.Q., Ireland. 12/8/21.

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R.G.A. Postings.—*Continued.*

Keogh, Lt.-Col. (Bt. Col.) J. H., D.S.O., from Pack Arty. Depôt, to 9th Pack Bde., India. 29/7/21.
Knight, Lieut. W. T., M.C., from Att. Royal Corps of Signals, to Att. R.G.A., Dover. 29/7/21.
Lindesay, 2nd Lt. E. M., from Royal Military Academy, to 10th Bde., Larkhill. 26/7/21.
Lyons, Lieut. J. M., M.C., from 5th P.A. Bde., to 42nd P.A. Batty. 10/8/21.
Mair, Capt. W., from 8th Bde., to G.H.Q., Ireland. 12/8/21.
Matterson, Major L. G., from Att. R.A.O.C., Rhine, to 1st Res. Bde., Fareham. 23/7/21.
Merrett-Stock, 2nd Lt. S., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Montague, Capt. J. E. F., from 10th Bde., to G.H.Q., Ireland. 12/8/21.
Moody, Lieut. W., M.C., from 8th Bde., to G.H.Q., Ireland. 12/8/21.
Nicol, 2nd Lt. W. P., from Royal Military Academy, to 8th Bde., Exeter. 26/7/21.
Parkinson, 2nd Lt. A. P. M. B., from Royal Military Academy, to 9th Bde., Bordon. 26/7/21.
Paul, 2nd Lt. C. R., from Royal Military Academy, to 9th Bde., Bordon. 26/7/21.
Phayre, 2nd Lt. R. A., from Royal Military Academy, to 9th Bde., Bordon. 26/7/21.
Pratt, Capt. F. W. H., M.C., from Att. School of Mily. Admn., Chisledon, to Att. 4th Bde. R.G.A., on completion of course. 4/8/21.
Russell, Capt. C. A., from H.Q. & D.E. R.G.A., Forth, to G.H.Q., Ireland. 12/8/21.
Saunders-Jacobs, Lieut. A. B., from 10th Bde., to G.H.Q., Ireland. 12/8/21.
Sexton, Lieut. A., from H.Q. & D.E. R.G.A., Portsmouth, to G.H.Q., Ireland. 12/8/21.
Shadbolt, Capt. C., from H.Q. & D.E. R.G.A., Thames & Medway, to G.H.Q., Ireland. 12/8/21.
Smith, 2nd Lt. I. K., from 10th Bde., to G.H.Q., Ireland. 12/8/21.
Spong, Capt. C. A. T., D.S.O., from Att. 4th Bde., to 15th Batty. 10/8/21.
Swan, Lieut. O., from H.Q. & D.E. R.G.A., Thames & Medway, to G.H.Q., Ireland. 12/8/21.
Titmas, Lieut. T. W. L., from 10th Bde., to G.H.Q., Ireland. 12/8/21.
Turnbull, 2nd Lt. L. C., from Royal Military Academy, to 4th Bde., Shoeburyness. 26/7/21.
Underhill, Capt. N., from unposted list (Leave), to G.H.Q., Ireland. 10/8/21.
Villiers, Capt. G., M.C., from 5th P.A. Bde. A.C., to 13th P.A. Batty. 10/8/21.
Watson, 2nd Lt. C. B. G., from Royal Military Academy, to 8th Bde., Exeter. 26/7/21.
Williams, Capt. E. J., from Att. H.Q. & D.E. R.G.A., Plymouth, to "J" Coast Batty. Plymouth. 4/8/21.
Winch, 2nd Lt. C. G. M., from Royal Military Academy, to 5th Batty., Exeter. 26/7/21.
Wood, Capt. R., from H.Q. & D.E. R.G.A., Dover & Newhaven, to G.H.Q., Ireland. 12/8/21.

Cancellation of Postings.

The posting of Lieut. F. W. Flood, R.G.A., to "K" Coast Batty., dated 28/6/12.

Staff Appointments.

Royal Artillery.

Ellershaw, Col. A., C.B., C.M.G., D.S.O., to be C.R.A., Malta (Temp. Colonel Comdt.) 5/4/21.
Galloway, Col. F. L., C.M.G., Member Ordnance Committee. 9/7/21
Lewes, Col. P. K., C.M.G., D.S.O., Member Ordnance Committee. 9/7/21.
Walshe, Col. F. W. H., C.M.G., D.S.O., A.-D.-C., to be G.S.O., 1st Grade (temporary). 20/5/21.

Royal Horse and Royal Field Artillery.

Alban, Lieut. A. H. A., D.F.C., Employed with Egyptian Army. 9/8/21
Archer, Major H., D.S.O., resumes appointment as Brigade Major of T.F. Division. 3/7/21.
Austwick, Lieut. W., employed as Adjt. of Poona Battn. Auxiliary Force, India. Seconded whilst so employed. 28/5/21.

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Staff Appointments.—*Continued.*

Cooper, Lieut. C. H., employed with King's African Rifles. 9/8/21.
Curzon-Howe, Lieut. A. P., A.-D.-C. to G.O.C., 1st Division (Tempy.) 1/6/21.
Cust, Lieut. L. G. A., A.-D.-C., to High Commissioner, C.-in-C., Palestine. 15/7/21.
Danbury, Lieut. J. H., M.C., seconded for service with Royal Corps of Signals. 1/7/21.
Down, Lieut. N. C. H., appointed Cipher Officer, Egypt. 25/7/21.
Gairdner, Lieut. C. H., Brigade Intelligence Officer, Ireland. Special Appointment, Class G.G. 10/2/21.
Green, Lieut. A. P., Appointed D.A.P.M. (Class F.F.) 6th Divisional Area; to be Temp. Captain whilst so employed. 5/7/21.
Hansard, Lieut. R. L., To Royal Corps of Signals. 1/7/21.
Harvie, Lieut. E., Appointed Tempy. Intelligence Officer, Constantinople. 15/8/21.
Jackson, Capt. C. R., M.C., Attached Tank Corps. 10/7/21.
Jones, Lieut. H. C. F., Staff Capt., A.G.3. (L) War Office. 12/8/21.
Skinner, Lieut. A. N., Seconded to Tank Corps. 8/7/21.
Smith, Lieut. A. C. S., Appointed Interpreter, G.H.Q., Mesopotamia. 16/5/21.
Spencer, Captain E. A., G.S.O., 3rd Grade, M.I.R. (a), War Office. 15/8/21.
Ward, Lieut. D. F., Appointed Adjutant, Bombay University Battn., Auxiliary Force. 1/7/21.
Wilson, Major D. C., D.S.O., Attached Officer, M.O.3. War Office. 12/8/21.

Royal Garrison Artillery.

Bell, Capt. L. G. R. F. H., M.C., to be Staff Capt., G.H.Q., "A" Mesopotamia. 1/6/21.
Bensley, Captain C. J. F., attached M.I.2., War Office. 8/7/21.
Bill, Major J. G., Seconded for service with Territorial Force. 30/6/21.
Brown, Lieut. P. W. F., Special appointment, Class G.G., while employed as an Intelligence Officer. 5/5/21.
Cooper, Lieut. (D.O.) J. N., To be Assistant to Chief Inspector, Inspection and Experimental Staff. 1/7/21.
Creswell, Lt.-Col. E. F., D.S.O., Assistant Director of Artillery, A.4. War Office. 16/7/21.
Ede, Lieut. C. W., Seconded, Student, Artillery College. 8/1/21.
Fryer, Captain F. E., Seconded to Tank Corps. 4/7/21.
Thompson, Capt. H. S., M.C., Appointed Acting Major and Acting Ordnance Officer, 3rd Class. 11/4/21.
Treatt, Capt. B. D. C., M.C., Appointed Adjutant, Tynemouth R.G.A., T.F. 5/7/21.
Vandeleur, Lt.-Col. H. M., C.B.E., Appointed Chief Inspector, Inspection and Experimental Staff, Woolwich. 9/7/21.

REGIMENTAL LIST. The following Casualties have taken place from 16th July, to 15th August, 1921.

The undermentioned Gentlemen Cadets, from the Royal Military Academy, to be 2nd Lieutenants, dated 13/7/21.

R.H. & R.F.A.

Akroyd-Hunt, John Akroyd.
Du Boulay, Thomas Houssemayne.
Fripp, Alfred Elton.
Gathorne-Hardy, John David, Earl of Cranbrook.
Godfrey, Anthony Frederick Halliday
Knox-Peebles, William Charles.
Larden, George Harold Neville.
Longfield, Richard James.
Neville, Ralph Dudley.
O'Sullivan, Frank Patrick Mockler.
Peter, George Alexander Crawford, M.C with seniority from 23rd Nov., 1918
Phillips, Harold Chetwode.
Turnbull, Douglas John Tulloch.
Wynter, Derek Edward Hugh, with seniority from 11th September, 1918.

Way, Alban Brian Menzies, Gentleman Cadet from the Royal Military Academy, to be 2nd Lieut. 13th July, 1921, with seniority next below 2nd Lieut. Gathorne-Hardy, J. D., Earl of Cranbrook. (*London Gazette*, dated 11th August, 1921).

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First Appointments.—*Continued.*

R.G.A.

Beville, Claude Hamilton.
Bromley-Kemp, Alexander Lowther.
Chesney, Mario John Peter.
Collier, Richard Douglas Tregonwell, with seniority from 27th April, 1919.
Crawford, John Murray Lalor.
Dobbin, Robert Wakeham.
Eyre, Frederick Charles.
Firbank, Leslie Telford.
Greig, Robert Beamish.
Hall, Henry Long Clifford.
Haslewood, William Gordon, with seniority from 15th May, 1918.
Hayes, Hilary Anthony.
Hooper, William Herbert.
Lindesay, Edward Mauleverer.
Nicol, Walter Patrick.
Parkinson, Anthony Percival Millais Brooke.
Paul, Charles Robert.
Phayre, Robert Arthur.
Stock Shoto Merrett, with seniority from 7th February, 1918.
Turnbull, Leslie Cuthbert.
Watson, Charles Benjamin Grylls.
Winch, Cosmo Gordon Montagu.

Promotions. (Regimental).

Armitage, Bt. Lt.-Col. C. C., C.M.G., D.S.O., to be Lt.-Col. R.F.A., and to remain seconded. 10/8/21.
Atchison, Bt. Lt.-Col. H. W., to be Lt.-Col. R.F.A. 10/8/21.
Belgrave, Major (Bt. Lt.-Col.) J. D., D.S.O., to be Lt.-Col. R.F.A. 21/7/21.
Erskine, Bt. Lt.-Col. A. E., D.S.O., to be Lt.-Col. R.F.A. 10/8/21.
Gray, Major W. K., D.S.O., to be Lt.-Col. R.F.A. 7/8/21.
Ingram, Major J. M., D.S.O., to be Lt.-Col. R.F.A., and to remain seconded. 10/8/21.
Langhorne, 2nd Lieut. E. W., to be Lieut. R.G.A. 30/5/21.
McLeod, Major N. M., D.S.O., M.C., to be Bt. Lt.-Col. R.F.A. 25/7/21.
Popham, Major G. L., D.S.O., to be Lt.-Col. R.F.A. 10/8/21.

Promotions. (Antedated.)

Harvey, Lieut. H. B., R.F.A., commission antedated for seniority as 2nd Lieut. to 6/8/15, and promotion to Lieut. antedated to 1/7/17, next above Lieut. W. S. Huddlestone.

Promotions. (Other than Regimental).

Deshon, Lt.-Col. F. G. T., to be Colonel (with seniority—6/4/21). 5/8/21.
Easton, Lt.-Col. F. A., D.S.O., to be Colonel (with seniority—1/5/21). 1/5/21.
Keogh, Lt.-Col. J. H., D.S.O., to be Bt. Colonel. 1/8/20.
Kinsman, Lt.-Col. G. R. V., C.M.G., D.S.O., to be Colonel (with seniority—17/1/21). 17/7/21.

To Temporary Half Pay.

Bingham, Lieut. R. H., M.C., to Temp. Half-pay list on account of ill health. 27/5/21.
Blower, H., Qr.-Mr. & Capt., to Half-pay on account of ill health. 6/8/21.
Campbell, Lt.-Col. N. St. C., C.M.G., D.S.O., to Half-pay after 4 years as Lt.-Col. 10/8/21.
Erskine, Lt.-Col. A. E., D.S.O., to Half-pay. 10/8/21.
Hartland-Mahon, Lt.-Col. M. C. J., D.S.O., to Half-pay on completion of 4 years service. 7/8/21.
Jensen, Lieut. G. H., to Temp. Half-pay on account of ill health. 12/8/21.
Roberts, Capt. A., R.G.A., to Temp. Half-pay on account of ill health. 29/7/21.
Sedgwick, Lt.-Col. F. R., C.M.G., D.S.O., to Half-pay. 4/8/21.
Tyler, Lieut. E., D.C.M., to Temp. Half-pay on account of ill health. 11/8/21.
Warburton, L.-Col. W. M., C.M.G., D.S.O., to Half-pay. 21/7/21.

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Cancellation.

The notification regarding Colonel L. D. Fraser, C.B., C.M.G., to the Half-pay List, dated 25/6/21, is cancelled.

Retirements on Retired Pay.

Birtles, Lieut. H., with rank of Major, from Half-pay list. 20/7/21.
Butcher, Lt.-Col. F. S., from Half-pay List. 20/7/21.
Davidson, Lieut. R. N., from Half-pay List. 11/1/21.
Glaysher, Capt. (Bt. Major) W. E., 20/7/21.
Gray, Lieut. W. J., 27/7/21.
Hamilton, Major (Bt. Lt.-Col.) G. T., D.S.O., 20/7/21.
Headlam, Maj.-Genl. Sir J. E. W., K.B.E., C.B., D.S.O., 11/8/21.
Hill, Capt. H. J., 26/7/21.
Lewis, Col. P. E., C.M.G., D.S.O., 1/8/21.
Lock, Capt. F. A. J., M.C., with rank of Major. 21/7/21.
McCulloch, Lt.-Col. R. H. F., C.M.G., D.S.O., granted Hon. rank of Brig.-Genl., from Half-pay List. 9/8/21.
McGrath, Lieut. J. C., M.C., with rank of Major. 4/8/21.
Musgrave, Bt. Col. A. D., D.S.O., with Hon. rang of Brig.- Genl., from Half-pay List. 21/7/21.
Smith, Lt.-Col. H. B., D.S.O., 1/8/21.
Tomkins, L.-Col. E. L., (Indian Pension), from Half-pay List. 16/2/21.
Woollcombe-Adams, Major C. E. G., 3/8/21

Retirements with a Gratuity.

Birch, Lieut. A. H., M.C., with rank of Capt. 29/7/21.
Elliott, Lieut. I., 13/8/21.
Futcher, Lieut. C. E., 9/8/21.
Hayward, Lieut. R. H. P., with rank of Capt. 13/8/21.
Humphris, Lieut. T. H., from Half-pay List. 8/2/21.
Hunter, Lieut. H. W., 9/8/21.
Jones, Lieut. W. E., O.B.E., from Half-pay List. 20/7/21.
Keates, Lieut. A. E., 9/8/21.
Thomas, Lieut. G., M.M., 30/7/21.
Wyatt, Lieut. A. E., To Retired pay with gratuity, from Half-pay List. 27/7/21.

Cashiered.

Goodman, Lieut. R. H. B., R.F.A., Cashiered by sentence of General Court Martial. Vide *London Gazette*, dated 9/8/21.

Death.

Stevens, Lieut. J. P., R.F.A., died in No. 23 Stationary Hospital, Amarah. 23/7/21

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Copies of the regulations of the Fund and other particulars relating thereto can be obtained from the Secretary at Simla.

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MAJOR-GENERAL C. E. D. BUDWORTH, C.B., C.M.G., M.V.O.

Born 3rd October, 1869. Died 15th July, 1921.

The following letters of appreciation of General Budworth's services have been received, and are published for the information of his brother officers.

From Lord Rawlinson, G.C.B., G.C.V.O., K.C.M.G., A.D.C., Commander-in-Chief in India.

In the passing of Major General Budworth the Army has lost one of its most valued and scientific Artillerymen and the Royal Regiment one of its keenest and most distinguished officers. As he served on my staff during the last three years or more of the Great War I am perhaps in a better position to realise his outstanding merit, than others who knew him less intimately. Not only did he possess a complete knowledge of the gunnery and tactics of his arm of the service but he was gifted with a power of organization and resource which was of infinite value to the armies in France as the artillery tactics developed month by month, and year by year.

I can recall innumerable occasions when at conferences or discussions his suggestions were of the greatest assistance to me in planning the artillery framework of the battle. His clearness of vision and his readiness to test the efficacy of any new development which might add to the fire effect of his guns and by that means assist the Infantry, were marked characteristics of his personality. I well remember at the commencement of the Somme battle in July '16 his suggestion to improve the Barrage. Up to that time it had been the practice for the Barrage to jump from trench to trench in front of the Infantry advance. It was he who first suggested that the intermediate spaces between the hostile trenches should be swept by fire in order to deal with machine gun emplacements which were so often to be found outside the trench lines. This was tried with success in the later stages of the Somme battle and eventually developed into the creeping Barrage which we knew so well in the later stages of the war.

He was further a strong advocate of concentration of fire. At Delville wood he concentrated the fire of no less than 360 guns on that single wood which up to that time was the maximum that had been attempted. Similarly at Belle Englise on the 29th September 1918 the concentrated bombardment he placed on that village was one of the main factors in the phenominal success of the 46th Division attack.

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But it was not only in the field of tactics that he excelled. Throughout the periods of preparation which must always precede a battle of any magnitude he was indefatigable in visiting all Artillery units and seeing personally to their requirements in men, horses, ammunition, etc. He possessed the faculty of winning the confidence of his subordinates by his unceasing attention to the business in hand and his complete knowledge of every phase and variety of Artillery science.

The Royal Regiment can never be sufficiently grateful to him for what he did for the gunners in the dark days of November and December 1917 in the Ypres salient. At no period of the war was the Artillery of all calibres at such a low ebb. In that cold, wet winter he did all that man could do to encourage, rest and reorganise them with the result that by the spring of 1918 they were once more in good fighting trim.

He has passed away a comparatively young man at the zenith of his career but he leaves behind him a record of which all gunners may be proud and has set an example which all would do well to follow.

Not only have I lost an intimate and very valued friend for whose high character and professional knowledge I hold a profound admiration, but the Army as a whole and particularly the Army in India has been deprived of one of its most distinguished and successful Artillery leaders, whose memory will live long and be much respected by his brother officers in the Royal Regiment of Artillery.

Rawlinson, Genl.

From Colonel The Right Hon. Lord Denbigh, C.V.O., T.D., Commanding the Honourable Artillery Company :—

In the summer of 1899 Captain C. E. D. Budworth was highly recommended to me as a most suitable officer for the Adjutancy of the H.A.C., due to become vacant in the following October, and I was fortunate in securing his appointment. He very soon showed his keen appreciation of the various weak spots existing in the Auxiliary Forces system, but very soon after his appointment, the South African War broke out. The H.A.C. undertook to form a 4-gun Field Battery, which proceeded to South Africa on February 3rd, 1900 under the Command of Major G. McMicking, late R.H.A., who was then commanding "A" Battery, H.A.C. The authorities allowed Captain Budworth, though Adjutant of the Regiment, to go as Captain of this C.I.V. Battery.

After a period of training on the Lines of Communication the Battery joined a Column under General Sir Arthur Paget. In a fight at Lindley in July 1900, a section C.I.V. and the 38th Field Battery under Major Oldfield, were surprised by a Boer attack from a neighbouring mealie field. Major Oldfield and all the officers and many men of the 38th, were killed or wounded, and several guns were captured.

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The C.I.V. section on the left flank was placed in great jeopardy for a time owing to the Colonial escort having retired through a mistaken order.

Captain Budworth at once mounted his pony, galloped after them and rallied and led them back under heavy fire and saved the situation by his cool courage and prompt action, which received high praise at the time. He rendered most valuable service until the whole C.I.V. force was brought home, prematurely as it turned out, in the following October and he was gazetted a Brevet Major in November.

His professional knowledge and the way he studied the comfort and care of his men, coupled with a great sense of discipline and a practical commonsense and tact displayed in instilling the same, made him a most valuable Adjutant for troops of the Territorial type.

In the autumn of 1903 he accompanied me as Adjutant of the 160 Officers and men who went to Boston, Massachusetts under my command on a visit to the States at the invitation of the Ancient and Honourable Artillery Company of Massachusetts, when we were accorded a most remarkable and historical reception in the fortnights' tour which had been arranged. This was the first occasion, since the American Revolution, on which a British Force with arms and Colours had landed as friends on American Soil. Prior to the departure of this detachment the whole H.A.C. had been reviewed by King Edward VII on the Horse Guards Parade, and Budworth received the honour of M.V.O. On completion of his 5 years term as Adjutant in October 1904, he was appointed an Instructor at the School of Gunnery. The H.A.C. owed much to him for his unfailing zeal and capacity as an Instructor and Organizer and he won the affection of all ranks.

He always kept in touch with the doings of the Regiment and during the late war he never failed to visit and encourage any of its Artillery or Infantry Units if he found himself in their vicinity. We all watched his career with the deepest interest coupled with pride at the thought that he had for 5 years been one of us.

Deep is the regret with which his old H.A.C. friends have read of his untimely and unexpected death.

September 1st, 1921.

Denbigh,
Colonel, H.A.C.

From Major-General Sir A. A. Montgomery, K.C.M.G., C.B. :—

To those who knew him "Buddy's" successful career during the Great War came as no surprise. If his chance came his personality, knowledge, and experience could not fail to bring him to the front.

He entered the "Shop" in 1887, on first commission he joined C/4, afterwards 27th Battery, R.F.A., at Trowbridge. He was posted to "J" Battery, R.H.A. in 1893, and served with it until promoted Captain on March 29th, 1899.

In the following autumn he went to the Honourable Artillery Company as Adjutant.

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The South African War gave him his first chance of active service.

He went to South Africa in Feb. 1900 as Captain of the C.I.V. Battery and took part in the Operations in the Transvaal, August and September, 1900. In Orange River Colony, including actions at Lindley (26 June), Bethlehem (9 and 7 July), and Wittebergen (1 to 29th July).

For his services in South Africa he was awarded a Brevet Majority.

On return to England after the S.A. War his great abilities soon brought him to the notice of those who were seeking for an Instructor at the School of Gunnery and in 1904 having been promoted Major, he joined the staff of the Horse and Field School of Gunnery becoming Chief Instructor in 1907.

On relinquishing his work at the School of Gunnery he was posted to "H" Battery, R.H.A. which he commanded until the outbreak of the Great War in August 1914.

His battery was not one of those originally detailed to form part of the Expeditionary Force and he had the mortification of seeing his best horses and men drafted away to other units; but, as was his invariable custom, he took this blow very philosophically and soon received his reward. His battery was reformed and went to France as part of the 1st Cavalry Division.

He was promoted Lieut.-Colonel on Oct. 30, 1914 and remained in Command of "H" Battery, R.H.A. until January 1915, when he was sent home to command 50th Brigade, R.F.A., 9th Division.

He re-embarked for France on 13th March, 1915 on re-appointment to R.H.A. and Commanded R.H.A., 1st Cavalry Division.

He went to the 1st Division as C.R.A. in July 1915.

In the summer of 1915 General Rawlinson was so struck with his powers of organization, energy, and technical knowledge that he obtained leave from General Headquarters to place Budworth in charge of the artillery preparations of the 4th Corps for the battle of Loos.

At that time our supply of guns and ammunition, it will be remembered, was still very limited and the task of the allotment of the most suitable tasks to the available artillery was no easy one. That the success of the attack of the 1st, 15th, and 47th Divisions of the 4th Corps on the enemy's defences round Loos on the 25th September 1915 was in great measure due to the artillery arrangements admits of no dispute, and the bold handling of the artillery during the battle that ensued furnished further proof of Budworth's outstanding qualifications to a high artillery command.

When the 4th Army was formed in February 1916, Budworth remained with the 4th Corps for a short time but as soon as the preparations for the battle of the Somme were taken in hand he was selected to go as B.G.R.A. to the 10th Corps which then formed part of the 4th Army.

In May 1916, when Sir Noel Birch was promoted from M.G.R.A. 4th Army to Lord Haig's staff at G.H.Qrs. Lord Rawlinson asked for and obtained Budworth's services as M.G.R.A. and during the re-

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mainder of the war and until April 1919 he served in that capacity on the 4th Army Staff.

The five months of the Somme fighting gave him the opportunity of introducing several innovations in artillery methods, and as the spring of 1917, when the enemy was retreating to the Hindenburg Line, brought us back for a short period to a state of open warfare, Budworth took full advantage to train his batteries to shake off the evil effects of so long a spell of trench warfare.

After spending the summer of 1917 amongst the sandhills on the coast near Dunkirk, where entirely new conditions prevailed, Budworth spent a busy winter reorganizing the artillery of the 4th Army in the Ypres salient after their devastating losses during the battles for the Passchendaele ridge. Never during the war had the Royal Artillery suffered so severely or endured such hardships as they did in the Ypres salient in 1917. Batteries were commanded by young second Lieutenants. Many were reduced to skeletons with only two or even one gun surviving above ground. Hundreds of guns were buried in the Flanders mud while the conditions under which the officers and men lived were beyond description. The resultant effect on the discipline and moral of the Royal Regiment was noticeable for the first time during the war. Almost more remarkable, however, was the rapidity with which it recovered its efficiency. Much of the credit for this recovery was undoubtedly due to Budworth's personality and to the loyal assistance he received from Corps and Divisional Artillery Commanders.

The defence of the hard tried British line in front of Amiens in the spring and summer of 1918 gave Budworth fresh fields for his energy and the opportunity, of which he took full advantage, of gaining the friendship and respect of the members of the Australian Corps.

Then followed the great advance from August to November 1918 and here again Budworth's great experience, powers of organization and indefatigable energy were of the greatest value.

At the storming of the Hindenburg Line at the end of September and especially in the artillery assistance he gave to the 46th Division in their famous crossing of the St. Quentin Canal he excelled himself.

A winter at Namur and a brief period of command of the 59th Division in France during the summer of 1919 completed his career in the Great War.

He was, however, not left long without employment. As soon as Lord Rawlinson was selected as Commander-in-Chief in India he asked for and obtained Budworth's services as Major General of Artillery at A.H.Qrs. India, where a considerable number of his old friends on the staff of the 4th Army had already preceded him.

On arrival in India in November 1920, Budworth lost no time in taking a grasp of his duties. During the cold weather he visited almost every gunner station in India and it is to be feared that in his endeavours to make himself acquainted with all the many factors affecting the welfare of the artillery in India that he overtaxed his strength.

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Arriving in Simla in April last after his last tour he looked far from well and his state of health caused us all much anxiety. Unfortunately a bad attack of malaria early in July still further reduced his vitality but no one suspected that there was any danger.

On July 15th after visiting the office in the morning, he had a sudden heart seizure in the evening at the U.S. Club, Simla, and died quite painlessly.

Nearly four years of intimate and affectionate association with "Buddy", first on the staff of the 4th Corps from July 1915 and afterwards on the staff of the 4th Army till it broke up at Namur in April, 1919, gave me a knowledge of his character and personality such as war alone can give. The most loyal of co-workers he had but two objects in view, the honour and welfare of the regiment and the defeat of the enemy. To him we owed many of the innovations in artillery tactics, which raised the reputation of the Royal Regiment to the high level it had reached at the end of the war, and gained for it the admiration of our allies. He had decided views which he never hesitated to express, and seldom did the results fail to prove that he was right. Many instances could be mentioned both during the long drawn battle of the Somme in 1916 and in the final successful advance by the 4th Army in 1918, where his prescience, decision of character and intimate knowledge of artillery, were important factors in the successes gained. To quote one instance only, it was to his artillery tactics that the final capture of Delville Wood in September 1916 was almost entirely due.

Nothing was more noticeable or more significant than the respect and affection with which he was looked upon by our brothers in arms from the Dominions. He delighted in spending long days in the trenches discussing artillery matters with the Australians and Canadians and many are the words of praise that I have heard from them about him.

Similarly during the Battle of the Somme a distinguished French gunner was attached to the H.Q. of the 4th Army. One could not fail to notice the high opinion that this officer held of "Buddy's" grasp of the essentials in artillery tactics and of his technical knowledge of the powers and limitations of this arm.

Intolerant of inefficiency, his ready help and advice were always at the disposal of those who served under him. To those with whom he worked he was always the same loyal friend and kindly companion.

A keen sportsman, with a high sense of honour, a great devotion to duty, and an intense love for the Regiment, his life will be an example to future generations of gunners.

Simla. A. A. Montgomery.
July 27, 1921.

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"DUNCAN" COMMENDED ESSAY, 1920-21.

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution of Horse Draught, both on the road and across country."

"Mony a Mickle Makes a Muckle."

BY CAPT. F. R. G. MILTON, M.C., R.F.A.

THE possibility of substituting mechanical draught for horse in the Artillery, has been discussed more or less seriously, ever since the day when the road motor became a working proposition.

For some years before the war the question of horsing the Artillery on mobilisation had been increasing in difficulty, and experience gained during the war showed that it was most improbable that sufficient horses would be forthcoming for another war on the same scale.

Early in 1915 guns were employed which could not be horse-drawn on account of their great weight.

To meet the requirements of the Siege Artillery, one or two very efficient motor-tractors were evolved—a great stride forward on the road to the tractor suitable for light Artillery. 1916 marked the first appearance of the tank, which besides a vast weight of armour, carried a pair of six-pounder guns.

Handicapped as they were by their great weight these tanks worked on the whole successfully, over all kinds of country; where horse-drawn batteries sometimes found it difficult to move.

The problem of applying mechanical traction to Horse and Field Artillery is most likely to be solved by a modification of either the Siege Artillery tractor or the tank; that is the guns will either be drawn behind a tractor, the gun and carriage retaining more or less its present form, or the gun will be mounted in the motor vehicle itself.

For brevity, this latter system will in future be referred to as "Tank Type," whether armour and caterpillar tracks are employed or not, the other will be referred to as "Tractor Type."

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It is necessary, before discussing the possibilities of mechanical draught, to be quite clear on what is required.

The machine in question has to establish such superiority over the horse as a means of draught, that its advantages will not only outweigh all the faults inseparable from any mechanical contrivance, however perfect, but also justify the expense and temporary loss of efficiency inevitable when such a radical reorganisation takes place.

The simplest way to arrive at these requirements is to compare the relative capabilities of horse and mechanical draught at the present day; it will then be possible, by taking into consideration the developments that may be expected, to see in what respects the machine is likely to improve on the horse.

The following table has therefore been drawn up, to show roughly the relative performance to be expected from horse and mechanical traction.

It is probable that mechanical transport has progressed further than has been assumed here; only a privileged few know what has been achieved with tanks since the Armistice, so it can be taken for granted that the powers claimed for mechanical draught in this table are very much under-estimated.

As a rapid comparison will show, the horse is already beaten in some respects; in others it is impossible that he will ever be surpassed, as, for instance, his power of living on the country, which is of importance in savage lands where communications are difficult.

This objection is reduced in view of the fact that Pack Artillery will have to be retained as they are never likely to be replaced by any Mechanical contrivance; Pack batteries would therefore be available for use in such operations.

For a European war because of its economy in man power, and the increasingly difficult problem of Horse supply, a mechanically-drawn Horse and Field Artillery becomes most desirable.

Later on will be shown in what respects this economy is effected.

It remains to be considered what form this motor traction should take, and the changes in tactics, organisation and training that may be expected to result from its employment.

Attention has already been drawn to the two possible varieties; Tank type, where the gun is mounted in the motor vehicle, probably taking a form similar to an unarmoured or only lightly armoured whippet tank; and the tractor type, in which the gun is drawn behind a motor tractor.

The special characteristics of each type are fortunately such that they meet the widely differing requirements of the several branches of light Artillery—Horse, Field and Heavy.

Field and Heavy Artillery.—The cases of Field and Heavy Artillery may be considered together.

These two arms depend for their effect mainly on developing fire from concealed positions.

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HORSE-DRAUGHT.	TANK-TYPE M.T.	TRACTOR-TYPE M.T.
1. Can cover up to 100 miles in four days without undue loss of efficiency.	Can cover about 70 miles per day.	* Can cover about 50 miles per day.
2. Maximum speed for short distance 12 m.p.h.	Maximum speed several miles. 12-15 m.p.h.	* Maximum speed short distance 12-15.
3. About 25 men per gun required in a battery.	About 12 men per gun required.	About 15 men per gun required.
4. Guns can go almost anywhere; horses themselves will never get stuck unless exhausted.	Cannot cross bad mud. Liable to get ditched and incapable of extricating itself without external assistance.	Cannot face worse ground than heavy plough.
5. Guns in action easy to conceal. Waggon-line hard to conceal. Tracks bad.	Guns in action hard to conceal, but very mobile. W.L. easy to conceal. Tracks not very obvious.	Guns in action easy to conceal. W.L. easy to conceal. Tracks not very obvious.
6. Preserves limited mobility till teams are reduced to pair of horses.	Vulnerable, but small target.	Vulnerable, but small target.
7. Supplies of forage usually obtainable in any country. If water is available can work for a few days on grazing alone.	Fuel supply essential.	Fuel supply essential.
8. Unskilled men trained to horses in six weeks (in emergency).	At least three months training for semi-skilled men, six months for unskilled.	
9. Supply uncertain and mainly from abroad, need much shipping.	Can be manufactured largely by women and unfit men—material available at home.	

[1] Experiment with Erhardt guns behind tractors in 1918, showed that the carriage could not stand up for twenty miles at 20 m.p.h.

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It is their invisibility that renders them immune to hostile fire, thereby enabling them to maintain their offensive power, and free choice of target.

No armour, however thick, would give them such protection; the experience of Naval warfare shows that the gun can always beat armour, and that the best way to protect a gun from one of equal power is to conceal it.

This means that Field and Heavy Artillery can never be replaced by armoured gun-tanks, since these are easier to spot, and consequently easier to neutralize.

When a field battery is in action, nothing unessential to the actual shooting should be on the position.

The importance of ease of concealment points to tractor draught as the most suitable for Field guns.

Further reasons for favouring it appear when the method in which these weapons are normally employed is considered.

The guns are brought into action as secretly as possible in a previously reconnoitred position; the approaches having been reconnoitred and the whole procedure being comparatively deliberate, serious obstacles can be avoided.

The guns must be as inconspicuous as possible from the ground or air.

They will probably be in action for some time without moving.

They will probably not be required to move at a greater pace than 6 m.p.h., as even the most perfunctory reconnaisance takes some minutes.

The shooting must be accurate; the ability to shoot on the move would rarely be an advantage.

It will be seen that the tractor type meets all these requirements, and from the most important point of view of ease of concealment has a great advantage over the tank type.

Existing guns can be adapted by strengthening the shield stays, sight brackets, etc., and improving the lubrication of the wheels.

A tractor can be designed to carry the ammunition and stores now carried in the limber, the personnel and kits of the whole or any part of the detachment, and an adequate supply of petrol. When in action there would only be the gun to conceal, as at present.

The ammunition waggon would be a large two-wheeled waggon body only, to carry about eighty rounds, with a fairly long perch to facilitate man-handling, of the French pattern which is 'upended' in action, the top lid being opened exposing the ammunition.

The ammunition tractor would be exactly similar to the gun tractor, and would also carry a limber supply of ammunition; waggons would unlimber in action.

Firing battery and first-line waggons would be provided as at present.

There would be great saving of space at the waggon lines; small compact caterpillar tractors not exceeding fifteen feet in length can be designed, of ample power and carrying capacity.

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As there would be no question of dropping the poles, taking the harness off, watering and feeding, etc. very few men need be kept at the waggon line, and they would be able to rest.

Fitted with broad tracks, ample gear ratios, and carefully protected engines, the tractors should take the guns over mud, sand, fords, etc., without difficulty, and leave far less conspicuous tracks on most surfaces than horse teams. Barbed wire in daylight or dark would have less terrors, and winter would not mean heavy and bulky horse-rugs and reduced pulling-power when it is most needed.

The sixty-pounder batteries would be organised in exactly the same way as the field artillery; the same tractors could probably be used, as the pace required is slower, and better ground usually chosen, the Heavies could then be absorbed into the Field Artillery.

This seems to complete the case for tractors in the Field Artillery.

Horse Artillery. The application of Mechanical draught to the Horse Artillery and 'close support' artillery presents a different problem.

The requirements of these two arms are very similar as far as M.D. is concerned.

Since the raison d'être of Horse Artillery is to work with cavalry, who move very rapidly and may employ either shock or fire tactics, the Horse Artillery must be very mobile, capable of moving at least as fast as Cavalry, capable of coming into action very quickly, and of developing a heavy volume of fire, rapidly, and probably only for a comparatively short time.

If on occasions it could fire when on the move, its value would be tremendously increased.

Should the cavalry become involved in a fire-fight, the supporting batteries are not likely to be in action under cover in one position very long.

In a rearguard action, a gun which can remain in action to the last moment and move off still firing, would be of tremendous value.

In the case of Horse Artillery, therefore, invisibility can be sacrificed if extreme mobility be gained.

The desired conditions are therefore best met by mounting the gun in the motor vehicle itself, that is, by adopting the tank type of motor draught.

The ideal to be aimed at seems to be a caterpillar vehicle on the lines of a whippet tank, capable of 15 m.p.h., unarmoured except for a gun shield, mounting a semi-automatic gun firing about a fifteen pound shell, carrying about one hundred rounds in the tank, capable of an all round field of fire, and about 30° elevation to deal with low flying aircraft.

To serve such a gun a detachment of about four men would be necessary.

The possibilities of such Horse Artillery are immense; it is no exaggeration say that a battery such as has been described working in

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open country would render mounted action of any sort by the opposing cavalry impossible.

Working with armoured cars, or light tanks, and supported by lightly equipped infantry carried in mechanical transport, they would be capable of performing all the functions of cavalry, and of covering far greater distances.

That, however, is concerned with the future employment of tanks, and is not a purely Artillery matter.

As an anti-tank weapon such batteries would be formidable. By manœuvring at speed and keeping at a range of about 600 yards they could engage large numbers of heavy tanks without much risk to themselves, as Infantry tanks are necessarily heavy and consequently slow to manœuvre, and being designed for fighting at close quarters have a very limited field of view.

A proportion of these Horse Artillery batteries could, with advantage, be armed with a small Howitzer, say 3·7 inch, to deal with strong points and improvised defences; the lesson of the cavalry advance on Cambrai on November 20th, 1917, shows the necessity of something of the kind well forward with the vanguard.

A battery of Horse Artillery tank guns would be best organised in six sub-sections, as at present, each to consist of one gun-tank, and two ammunition tanks exactly similar to the gun-tank, and fitted for mounting the gun, carrying one hundred rounds of ammunition each, and a supply of petrol and oil.

Close Support Artillery.—should it be thought necessary to train special units to work close up to the infantry, it would be found that every attribute that renders the tank type suitable for Horse Artillery fits it for the task; certain Horse Artillery batteries could be specially trained and equipped with a little armour and reduced gear ratios, and one section re-armed with light trench-mortars in each battery.

To sum up, Horse and Close support Artillery, by adopting mechanical draught, would gain mobility, both in speed and distance covered; ease of getting into, and out of action; ability to fire while moving; increased fire-power, and economy in men.

Field and Heavy Artillery would gain all these except the power to fire on the move, they also gain slightly increased ease of concealment by the reduction in the size of the waggon-line, and the partial elimination of tracks.

Before going on to the question of ammunition and fuel supply, it would be as well to consider how battery commanders and battery staff are to do their work without horses.

During the War, Siege Artillery officers found cars and motor bicycles quite efficient substitutes.

By careful training, and very careful map-reading, cars and motor bicycles would enable battery staffs to work sufficiently quickly for Field and Heavy Artillery requirements.

In close country, like parts of Europe, there are sufficient roads to enable a car to get reasonably close to any particular objective, and

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in open country a car, such as the Ford, is capable of going across country to large extent.

The B.C.of a battery working with cavalry will frequently be unable to use his car, in this case he will have to ride on one of his gun-tanks, occasionally the cavalry will have to be prepared to mount him.

In a close-support battery, the staff (which in such a battery would be very small) would use the car for any early reconnaissance, once in action they would in any case have to work on foot.

Coming into action in the open, much might be done by the B.C. riding on one of his gun-tanks and directing his battery by signal.

Ammunition Supply. The ammunition supply system can remain practically unchanged.

Divisional Ammunition columns would have gun and howitzer supply sections, equipped half with Lorries and half with tractor ammunition waggons of Field Artillery pattern.

The Small Arm section does not come within the scope of this essay, but would probably be equipped with a proportion of carrier tanks.

Fuel supply would have to be taken out of the hands of the R.A.S.C. and given to the gunners.

An additional section, "the Fuel Section" added to the D.A.C., would best cope with this.

The above also applies to Horse Artillery columns.

If it is ever decided that ammunition supply is to be handed over to the R.A.S.C., they must become responsible for fuel supply as well. Artillery fuel and ammunition will have to be supplied by the same formation, whether it is manned by R.A.S.C. or R.A., for both supplies must be in the hands of one unit in closest touch with the Artillery.

The necessity of providing orderlies and guides, and communications generally makes it most desirable that both these necessities shall be drawn from the same place if possible.

Recruiting and Training. The recruiting of the personnel of a mechanically drawn Artillery will get simpler as time goes on.

The use of mechanical transport is becoming more general throughout the Kingdom, and consequently the number of men with mechanical knowledge is increasing.

The experience of the mechanical transport schools organised during the period of demobilisation in 1919, was that a very large proportion of men wished to learn something of this trade.

Training. During the War, the Tank Corps found it possible to train their recruits both to drive and to serve in the gun detachment.

As this was possible even in wartime, it shows that the average man does not find much difficulty in picking up the necessary amount of knowledge to enable him to drive such a vehicle, consequently, it seems possible that every Artillery recruit should be thoroughly trained in both.

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A way in which our present organisation could be adapted to meet these new requirements, is something as follows :—

Depôts—to be maintained as at present.

Reserve Brigades—to be retained; instruction in discipline, drill, P.T. etc., standing gun-drill and elementary instruction in running and tending motors (no driving).

Field Artillery Brigades—to be maintained at a suitable reduced establishment.

One central mobilisation park for all mobilisation tractors and tanks in each command.

Horse Artillery Batteries—increased in number, and maintained at suitable establishment.

Training Establishments—For the first few years after re-organisation, large training establishments would be required, at Home and abroad, with full-strength batteries attached, to enable extensive tactical exercises to be carried out at all times of year. Salisbury Plain would be the most suitable place in England for such schools; where, besides tactical training for officers, extensive courses in driving etc., could be held for N.C.O's and men.

Fitters and artificers could be attached to the firms manufacturing the tractors, while the re-equipment is taking place; this system of training specialists has been tried with success in the Navy.

In about three years sufficient personnel would have been thoroughly trained to allow a large proportion of the training establishments to be closed down, a special Artillery School for fitters and artificers could then be started.

In India, the temporary training schools could be abolished altogether at the end of this period.

Territorial Force—For economy, and because instructors would at first be difficult to spare, the Territorial Artillery would have to consist entirely of tractor-drawn guns, the Horse Artillery being temporarily armed as Field.

Pack Batteries—The question of the number of pack batteries to be maintained depends entirely on Imperial policy.

Apart from the Mountain Batteries that have to be kept in India, Palestine, and Egypt, we may be called upon to provide mobile batteries in out-of-the-way spots where mechanical batteries could not work and would be difficult to maintain.

There are such places as the bush country in Africa to be considered, and ventures such as the assault on Gallipoli, where the landing of mechanical batteries on the first day might have proved difficult.

In all such cases, the pack-batteries would be employed.

Economy in Man-Power—As has been mentioned before, it is its economy in man-power that makes mechanically drawn Artillery essential to us, if we are to hold our own in any future European war.

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This economy is effected not only by the reduction in the number of men per gun actually in the field, but because fewer able-bodied men need be employed in its interests out of the firing-line.

Once a suitable design has been evolved, and plant laid down, less men and money will be required to manufacture and maintain such an arm than are needed to purchase, handle, and doctor remounts for an equal number of horse-drawn guns; and there will be less wastage.

What is more, the munition-workers engaged in producing it need only a small proportion of men of military age, most of the skilled work is done by men of forty-five and upwards, heavy work can be eliminated in a factory by suitable system and appliances, and the rest done by women.

When not in work, tractors and tanks do not, like horses, require to be fed, and the materials for their manufacture are to be obtained at Home; whereas, the greater proportion of horses have to be imported from abroad.

In both these respects shipping is saved, a vital factor in any war waged by Great Britain.

To conclude, the following figures and establishments, though rough, are significant:—

Weight of forage required by battery of 160 horses marching one hundred miles (calculated at twenty-five miles per day, twelve pounds of corn only per horse daily).

8,000 lbs. (about 400 cubic feet in bulk).

Weight of fuel required by a mechanical battery in covering one hundred miles. (Time taken fifteen hours, eighteen vehicles of forty horse-power each).

5.000 lbs. (about 125 cubic feet in bulk).

Suggested establishment of 18-pdr. battery tractor-drawn:

MATERIAL.		PERSONNEL.	
Guns q.f. 18-pdr.	6	Major	1
		Captain	1
Amn. Wn. bodies	12	Subalterns	4
		B.S.M.	1
Tractors	18	B.Q.M.S.	1
		Fitter S/Sgt.	1
Motor bicycles	8	Sgts.	7
		Fitters	3
Car	1	Signallers	8
		Gunners	54
Lorry	1	Drivers	24
TOTAL:			
		Officers	6
		O.R.	99

Road space in column of route 10 yds. between vehicles—405 yds.

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Suggested establishment Horse Artillery battery (Tank Type).

MATERIAL.		PERSONNEL.	
Gun tanks	6	Major	1
		Captain	1
Amn. tanks	12	Subalterns	4
		B.S.M.	1
Motor bicycles	8	B.Q.M.S.	1
		Fitter S/Sgt.	1
Car	1	Sgts.	7
		Fitters	3
		Signallers	8
Lorry	1	Gunners	24
		Drivers	24
TOTAL :			
		Officers	6
		O.R.	69

Road space in column of route 10 yds. between vehicles—370 yds.

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THE HISTORY OF THE SUPREME WAR COUNCIL FROM ITS CREATION.

November 7th, 1917.—November 11th, 1918.

Translated from the *Revue Militaire Générale*—February, 1921.

BY MAJOR E. M. HUTCHINSON, D.S.O., R.F.A.

[NOTE.—Reference was made to a certain book that appeared on this Subject, in a Lecture given at the R.A. Institution in the Spring. It was felt that the publication of this Article might be of interest. Curiously enough an abridged translation has been published in the Journal of the Royal United Service Institution for August "As a corrective to a certain sensational work,"—Ed.]

The Inter-Allied Conferences prior to the Supreme War Council.

The necessity for union between the Allies had been understood by everyone from the very beginning, but, it was difficult of realization because there did not exist between the members of the Entente any subordination like that which proved of such great advantage to the Central Powers.

A long, difficult, and perilous time had to be gone through before this idea reached maturity, and disasters were necessary to cause real action to be taken, but in the end the result was marvellous, nothing less than Victory.

The first steps towards this union were made by the French Government. A Conference of the military authorities of the Allies took place for the first time at Chantilly on the 10th of July, 1915. It was proposed by the French Prime Minister, M. Viviani, and the War Minister, M. Millerand, and was rendered possible by the unquestioned prestige of the French Commander-in-Chief, General Joffre. The result was the double offensive in Champagne and Artois.

The utility of these conferences having been proved by experience, M. Briand, when he was Prime Minister, wished to obtain the co-ordination of the different fronts, and to prepare for this he increased General Joffre's powers by making him Commander-in-Chief of the French armies on all the fronts.

The latter assembled at his headquarters at Chantilly on the 5th, 6th and 8th of December, 1915, the Commanders-in-Chief, the most important Generals, and the Chiefs of Staff of the Allied powers. This second conference decided on an offensive to be made by the French armies in the North, and by the group of English armies on the two banks of the Somme.

But in 1916 the enemy forestalled us, and delayed the realisation of our plans. The threat of danger brought about the third inter-Allied Conference, which, at Chantilly on the 14th of March, 1916, decided on a general counter-offensive. The Russians were to begin on the 15th of May, and the Italians, British and French were to continue the movement fifteen days later.

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At the end of 1916 the situation had been restored by Broussilof's Campaign, by our wonderful resistance at Verdun and by the battle of the Somme. In order to prepare a plan of campaign for 1917, General Joffre summoned a fourth inter-allied Conference[1] at his headquarters on the 16th of November, 1916, and the broad lines of a combined offensive to take place in February 1917 were settled.

At the beginning of 1917 the British Government thought that in the existing conditions it was advisable to discuss "in a very frank manner" not only the recent events in the Balkans, but also all the aspects of the campaign for 1917. An Allied political Conference was therefore held at Rome at which only members of the British, Italian and French Governments were present.

The British Prime Minister, before beginning the discussion, asked for "the greatest frankness," adding that, as a result of constant meetings, the French and British representatives had become accustomed to this procedure, and expressing the hope that the Italians would fall in with it also.

It was necessary for the three Nations, sitting in Council, to confer with each other in the freest manner possible in that hour of terrible crisis and to make every effort to reach a complete understanding. It was in such an understanding that Mr. Lloyd George saw the only means of assuring the cordial co-operation which was essential for victory, because it alone could counterbalance the enormous advantages which the enemy had derived from the fact of his unity of command.

"The moral and material resources of the Allies," he said, greatly surpass those of the enemy. The Entente Powers have more men, more guns, greater resources; they can draw on the whole world. Up till now, however, they have not been able to overthrow their common enemy. Why? Because the Emperor of Germany controls all the resources of the Central Powers, and he is in a position, after taking into account all the circumstances, to employ them for any purpose in the most effective manner."

Placing his finger on our lack of union, he added, "During the year 1916 each of the armies of the Entente has waged its campaign with the greatest skill and courage. One cannot helped being filled with admiration at the way in which each has fought. We feel however that each nation has concentrated its efforts too largely on its own front, with the result that the advantages which the Allies hold in men and resources have not been made use of to the fullest degree."

He concluded by asking the Conference to present in a concrete form the principles discussed at the Council of the 16th of November, 1916, and to find a practical solution for them.

[1] The records of the Conference were signed by General Wielmans, Chief of the General Staff of the Belgian Army. General Sir W. Robertson, Chief of the British Imperial General Staff, General Sir Douglas Haig, Commander-in-Chief of the British Armies in France, General Porro, Chief of the General Staff of the Italian Army. Colonel Rudeanu, Head of the Rumanian Military Mission at the French G.H Q. General Palitzine, representing his Majesty the Czar, Commander-in-Chief of the Russian Forces and Head of the Russian Military Mission, General Rachitch, the delegate of the Servian Army at the French G.H.Q., and General Joffre, Commander-in-Chief of the French Armies.

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This was a great step forward, but although there was an easy solution, no means were found of adopting it.[1]

A little later a fresh inter-Allied political and military Conference was held at Calais on the 26th and 27th of February, 1917, at the instance of the British Prime Minister.[2]

The result was an agreement by which the British Armies were temporarily placed under the control of the French Commander-in-Chief, General Nivelle. The failure of the attack of the 17th April destroyed the results of this provisional agreement. The question of unity of command, which was on the point of being settled, could no longer, at any rate for the moment, be discussed.

During the month of July, the French General Staff drew up a note on "the constitution of an inter-Allied General Staff." After stating once again the advantages of unity of command in Germany and the inconvenience among the Allies of "the complete lack of centralisation in the Higher Command," it was proposed by this scheme" to do away with this cause of inferiority, or at any rate to diminish its effects, by creating a central inter-Allied body composed of high military authorities having the confidence of the Commander-in-Chief, capable of expressing an opinion which carries weight and which can be considered without delay by the Commanders-in-Chief, or even, in a crisis, of making rapid decisions in its own name which can be put into execution at once."

"But in order that the delegates provided for above shall be in a position to make decisions or to give well-founded advice, it is necessary that these decisions shall always be based on a correct and intimate knowledge of the situation, and on the general requirements of the Coalition. In other words, it is necessary that the required information shall be furnished by an inter-Allied General Staff, whose duty it is to study and keep in constant touch with all the questions bearing on the general direction of the war."

Mr. Lloyd George, for his part, arrived at the same conclusions. In a letter which he addressed on the 30th of October, 1917, to our Prime Minister, M. Painleve, he says :—

"The Allies will only be able to gain the final victory if they subordinate everything to the one aim of exercising in the most efficient manner on the Central Powers the greatest military pressure, both economic and political, which they are capable of exerting."

"I am sure that there is only one way to arrive at this result, and that is by the creation of a collective Body—a sort of inter-Allied

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[1] The Conference only adopted the two following resolutions :—

(i). If common action on the part of the Allies is necessary on the Italian front, France and England will despatch troops there. The details of execution to be drawn up by the military experts.

(a). The organisation of an inter-Allied General Staff to be studied at one of the Conferences which will be held in future every two months by the Prime Ministers of the Entente.

[2] The following were present: Mr. Lloyd George, Marshal Haig, General Robertson, Chief of the Imperial Staff, Sir Eric Geddes, M. Briand, General Lyantey, M. Claveille and Generals Nivelle and Ragueneau.

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General Staff—which will draw up the plans of campaign for all the Allies, and keep a continual watch on the course of events. This council evidently cannot take the place of the different Governments, it can only guide them, leaving them to give the definite orders and to make decisions, but it should be a Council which has full knowledge of the resources of the Allies, not only in men and material, but also in the means of transportation by sea, rail etc., it would act as a sort of a General Staff of the Alliance, to study the best means of obtaining victory on all the fronts and with all the resources combined. Its composition must be settled later, but I think that from this moment it should consist of one or perhaps two Ministers of Cabinet rank from each of the Allies, and, in addition, each nation should be represented by a military and, if possible, a naval and economic staff.

"The military representatives should sit in permanent session at a place to be chosen as the seat of this Council, and, therefore, could not be the different Chiefs-of-Staff, but they should always be in close touch with the latter. The same applies to the naval and economic representatives if its thought necessary to attach them to this Body."

A rough draft accompanied Mr. Lloyd George's letter, but it was only "a draft of the proposed composition of a supreme inter-Allied Secretariat, its relations with the inter-Allied Staff and the different Governments."

Agreement on these lines seemed possible. This was then the position of affairs: the inter-Allied Conferences had been judged insufficient, the attempt to establish unity of command had failed, the latest effort tended towards the creation of an inter-Allied Staff.

Creation of the inter-Allied Supreme War Council.

Events were to hasten a decision. Immediately after the disaster at Caporetto—France and England kept their promise and sent an army to Italy.

The French and British Prime Ministers first met in London, afterwards in Paris, and then went to Italy together to discuss with the Italian Prime Minister the measures to be taken. The Conference took place at Rapallo, at the Nouveau Casino Hotel, on Wednesday the 7th of November, 1917.

The following were present with Messrs. Lloyd George, Painlevé and Baron Sonning: representing England, Lieut.-General Smuts and General Sir W. Robertson; representing France, M. Franklin-Bouillon, a Member of the Government and of the War Cabinet, M. Barrère, French Ambassador at Rome, General de Gondrecourt, Military Attaché, General Foch, Chief of the General Staff, and General Weygand.[1]

The proposals which had been agreed to by Messrs. Lloyd George and Painlevé were discussed and adopted with a few alterations. The Supreme War Council was established.

[1] The Secretariat of the Conference was composed of Lieutenant-Colonel Sir N. Hankey, Secretary to the British War Cabinet, Count Aldovrandi, head of Baron Sonnino's Cabinet and Major Helbronner, Secretary to the French War Cabinet.

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In order that it should be independent and might be able to give the impression of being independent, Mr. Lloyd George pressed that the Council should not sit at Paris but at Versailles. "I remember, he said, this historical fact that the German Empire was proclaimed at Versailles, and I also hope that the Prussian domination will be broken at the same place."

The following decisions were taken :—

(1). With a view to assuring better co-ordination of military action on the Western Front in Europe a Supreme War Council is formed, composed of the Prime Minister and a Member of the Government of each of the Great Powers whose armies are fighting on this Front. The extension of the Council's powers to other Fronts will form the subject of discussion later with the other Great Powers.

(2). The function of the Supreme War Council is to supervise the general conduct of the war. It will prepare the outline of the Governments' decisions, see that they are carried out, and report to the different Governments concerned.

(3). The General Staff and military commanders of the armies of each of the powers charged with the conduct of military operations remain responsible to their respective Governments.

(4). The general plans of campaign drawn up by the competent military authorities to be submitted to the Supreme War Council, which, acting with the authority of the Governments, will secure their co-ordination and suggest, if necessary, any changes.

(5). Each Power to delegate a permanent military representative to the Supreme War Council whose exclusive rôle shall be that of technical adviser.

(6). The military representatives to receive from their Governments and the competent military authorities of their Countries all plans, information and documents relative to the conduct of the war.

(7). The military representatives to keep the Supreme War Council permanently informed on all matters concerning the forces and means of all description at the disposal of the allies and the enemy.

(8). The Supreme Council to sit normally at Versailles where the permanent military representatives and their staffs shall take up their residence. It can hold its sittings elsewhere by special arrangement and according to circumstances.

The meetings of the Supreme War Council to take place at least once a month.

The permanent military representatives in the Supreme War Council to be :—

For France—General Foch.[1]
For Great Britain—General Wilson.
For Italy—General Cadorna.

[1] General Foch never was, however, the French military representative. Seeing that he was and remained Chief of the General Staff, article No. 5 of the Rapallo Agreement prevented him combining these two functions. He was almost immediately replaced by General Weygand.

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The results of the Rapallo Conference were made public by a statement given to the Press.

In the speeches they made afterwards the British and French Prime Ministers explained the decisions arrived at, and made clear the advantages which they expected would accrue therefrom.

Lloyd George declared that the creation of this Supreme Council was the proof that the Entente had learnt the great lesson of union which had been given by events. "Unless I am mistaken in my conjectures," he added, "this Council will have real power, the efforts of the Allies will be better co-ordinated, and victory will be the reward of bravery. There will come the moment when we shall even bless the Italian disaster, for without it I doubt whether it would have ever been possible to arrive at any real unity. We have reached the conclusion that a permanent Council should take the place of the heavy and clumsy procedure of Conferences. . . . . Now that this Council is established it is for us to act in such a way that the unity which it represents shall be a reality and not a sham."

Painlevé, for his part, affirmed that this Council successfully reconciled the natural independence of the Allied Powers with the unity of direction which the conduct of war demands if it is to be effective. Before the French Parliament, when the solution was considered insufficient, he defended himself as follows :—

"There can be no unity of action without preparation. Even if you had been able in some way or other to get our Allies to consent to the appointment of one General to the Supreme Command of all the armies, this General could only carry out his rôle if he had, as an organ of intelligence, an inter-Allied Staff exactly similar to that which we have formed. You must not ask for the impossible and reject a plan because it is not as perfect as might have been hoped. If we ever succeed in establishing unity of command it will be through the exercise and action of this inter-Allied Staff which has just been formed."

This Staff took up its quarters at Versailles, in the Trianon Palace Hotel, which was requisitioned by the French Government.

The Meetings of the Supreme War Council.

The second session of the Supreme War Council took place in the Trianon Palace at Versailles on the 1st December, 1917. M. Clemenceau presided, and in addition to Mr. Lloyd George and M. Orlando, Colonel House represented the American Government.[1]

[1] There were also present at this sitting: Representing France, M. Kilotz, Minister of Finance, General Foch, Chief of the General Staff and General Weygand, French military representative; representing Great Britain, Lord Milner, Minister without portfolio, General Robertson, Chief of the Imperial General Staff and British military representative, General Macdonogh, Director of Military Intelligence, General Sackville-West, Chief Staff Officer to General Wilson and Lieutenant-Colonel Hankey, Secretary to the War Cabinet; representing Italy, General Cadorna, Italian military representative, Colonel Pintor and Dr. Petrozielli; representing the United States of America, Mr. Crosby, Assistant Secretary to the Minister of Finance, General Bliss, American military representative and Mr. Auchincloss. The Secretaries were: Major Pagezy (France); Lieutenant-Colonel Storr, Captain Amery (Great Britain) Interpreter Lieutenant-Colonel Spiers.

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M. Clemenceau opened the discussion by a speech the substance of which had been settled in agreement with Mr. Lloyd George. Taking a general survey of the situation he indicated to the military representatives, whose function it was to secure the discharge of the permanent duties of the Supreme War Council, the method of working which seemed to him the best for the inter-Allied Staff, laying particular stress on the inter-Allied nature of this body and the desire of the Council to provide it with all necessary documents.

Then, examining the situation in Italy, the Supreme War Council decided to call on its military advisers to draw up a combined plan of campaign.

The question of transportation was also considered, not only by rail between France and Italy, but also by sea to the East.

The situation at Salonika was discussed, "concerning which," declared M. Clemenceau, "the truth is we know nothing, or at any rate what we do know is not very favourable."

M. Venizelos was heard by the Council on this subject.

The third Meeting of the Supreme War Council was held on the 1st of February, 1918.[1]

The sitting opened with a discussion of the proposed plan of operations for 1918 drawn up by the military representatives, and this was adopted. While on this subject, the question of creating a general Allied reserve arose. General Foch pointed out the necessity for this, and General Bliss supported him; General Robertson drew special attention to the question of the command of this reserve.

The War Council then set to work to study the question of a Supreme Command whose duty it would be to consider the composition, maintenance, movement and employment of general reserves.

The discussion was a long one, for the difficulty was to create a body which would not supplant the Council and usurp the power which the latter reserved to itself.

On the 2nd of February an agreement was reached, the military representatives proposing as a solution the establishment of an Executive Committee. General Foch was unanimously elected as head of this Committee.

The following resolution was adopted :—

Resolution concerning the composition and handling of a General Reserve :—

(1). The Supreme War Council decides to create an Allied General Reserve for the whole of the armies on the Western, Italian and Balkan Fronts.

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[1] The following were present : France, M. Clemenceau, Prime Minister and War Minister, M. Pichon, Minister for Foreign Affairs, General Foch, Chief of the General Staff, General Pétain, Commander-in-Chief, General Weygand, military representative; Great Britain, Mr. Lloyd George, Prime Minister, Lord Milner, Minister without portfolio, General Robertson, Chief of the General Staff, Marshal Haig, Commander-in-Chief, General Wilson, military representative; Italy, M. Orlando, Prime Minister, Baron Sonnino, Minister for Foreign Affairs, General Alfieri, War Minister, General Cadorna, military representative; United States, General Bliss, military representative, General Pershing, Commander-in-Chief.

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(2). The Supreme War Council delegates to an executive composed of the permanent military representatives of Great Britain, Italy and the United States of America, with General Foch for France, the powers detailed hereafter which shall be exercised after consultation with the Commander-in-Chief of the armies concerned :—

(a). To decide the strength in troops of all arms and the composition of the general reserve, as well as the contribution to be made to this reserve by the army of each Country;

(b). To settle its position;

(c). To make the necessary dispositions for its movements and concentration;

(d). To draw up and give the orders for this general Allied reserve dealing with the time, place and duration of its employment;

(e). To fix the moment, place and strength of the counter-offensive, and the detail of troops necessary for the operation;

(f). So long as the units of the general inter-Allied reserve are not moved they remain under the orders of their respective Commanders-in-Chief (e.g. for discipline, training administration). Their move can only be ordered by the Executive Committee.

(3). In case of a difference of opinion each military representative to have the right to refer the matter to the Supreme War Council.

(4). The Executive Committee to have the right to visit any theatre of operations.

(5). The Supreme War Council to appoint the President of the Executive Committee.

By a second resolution the Supreme War Council appointed General Foch President of the Committee.

After this the question of the extension of the British front, to which Mr. Lloyd George was opposed, was examined. It was decided that the British and French Commanders-in-Chief should arrange between themselves all details for carrying out this extension.

Finally, before separating, the Heads of the various Governments decided to show their spirit of harmony.

They communicated to the Press a statement in which they declared their intention of pursuing the war energetically, as, in spite of careful examination, they had not been able to find in the recent speeches of the Chancellor and Austro-Hungarian Foreign Minister anything which approached the moderate terms which they were offered.

The fourth meeting was held in London, (Downing Street) on the 14th and 15th of March, 1918.

Everyone felt the threat of a great German attack on the British front. Owing to the march of events, the Council, without abandoning the principle of a general Allied reserve, was obliged to postpone its formation. It organised however the core of this reserve with the Franco-British divisions from the Italian front. It decided as well that the Italian divisions should be joined to them, the number of these to be fixed by the Executive Committee. A Committee of Generals was,

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in addition, to go to Italy to examine this question with the Commander-in-Chief of the Italian Army. The American divisions as they arrived in Europe were gradually to relieve and liberate the Allied divisions which had been engaged in the battle, and these would then rejoin the general reserve.

The Council examined some other questions. It admitted the principle of Japanese intervention in Siberia, the details of which were left to be studied at a diplomatic Conference. It also discussed the reprisals to be made by the Allies for enemy air raids, and the supply of coal to Italy.

Finally, it considered the eventual seizure of Dutch merchant shipping, and studied the use to which this shipping could be put in case it were requisitioned.

Then, all of a sudden, the Germans launched their offensive which from the outset gave them great advantages. It was at this moment that it became imperative to take the decisive step which in the first place had been shirked, but which had been prepared and facilitated by the Supreme War Council: "Unity of Command was achieved."

By the agreement reached at Doullens on the 26th of March, 1918, which was signed by M. Clemenceau and Lord Milner, General Foch was charged with the task of co-ordinating the operations of the Allied Armies on the Western Front. The Generals Commanding-in-Chief with whom he had to work were asked to provide him with all the information which he required.

But it was soon realised that this vague arrangement was not sufficient. On the 3rd of April, 1918, the leaders of the British, French and American Armies, and Generals Wilson, Bliss and Foch signed the Agreement of Beauvais which established unity of command and endowed it with full powers.

"General Foch is charged by the British, French and American Governments with the task of co-ordinating the operations of the Allied Armies on the Western Front; in order to carry out this task effectively all the necessary powers are conferred upon him. With this object the British, French and American Governments entrust to General Foch the strategic control of military operations.[1]

"The British, French and American Commanders-in-Chief remain in full tactical control of their armies.

Each Commander-in-Chief shall have the right to appeal to his Government if, in his opinion, his Army is placed in danger by any order received from General Foch."

But the German menace continued, and it was necessary to take steps to place in the hands of the Generalissimo all the means which he required.

The Supreme War Council met at Abbeville on the 1st and 2nd of May, 1918, to hold its fifth session.

[1] As a result of this, and the selection of General Weygand as Chief Staff Officer to General Foch, General Berlin was appointed French Permanent Military Representative at the Supreme War Council at Versailles.

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As far as the Higher Command was concerned, it was decided to suppress the Executive Committee for which there was naturally no further use in view of the new powers conferred on General Foch.

Then M. Orlando accepted the extension of General Foch's powers to Italy, so as "to assure the co-ordination of the efforts of the Allies," and this was adopted by the Supreme War Council. Touching the question of effectives the Council considered several methods of increasing them.

Mr. Lloyd George asked for the return of British battalions from the Salonika front and their replacement by Hindu troops, and the Council, thinking that the additional support given by Greece should make it possible to bring some troops back to France without endangering the situation at Salonika, decided to send a Committee of British and French Generals to General Guillanmat to study this question. It was recognised as indispensable, and agreed to, that Czech troops coming from Russia, and at that moment in course of being transported by the Trans-Siberian Railway, should be hurried to the Western Front.

Finally, General Foch made a pressing demand on the United States that 120,000 infantry and machine-gunners should be sent monthly to France (at any rate during the months of May, June, and July). The Council decided, in addition, that it was advisable that an autonomous American army should be formed as soon as possible, but that in view of circumstances, the Milner[1] agreement should be extended to June with the increase of men which the tonnage available allowed.

Other resolutions were also accepted in the course of this meeting dealing with the best means of employing the resources of the Belgian railways, the despatch of rolling stock from the United States, the situation in the East and inter-Allied naval operations in the Adriatic.

The sixth sitting of the Supreme War Council was held at Versailles from the 1st to the 3rd of June, 1918.

The question of effectives continued to be the order of the day.

"There is a great danger that we shall see the war lost unless the arrival of American troops allows us to remedy the numerical inferiority of the Allies as quickly as possible." (Telegram to President Wilson.)

General Foch proposed asking President Wilson to send 200,000 men in June and July. President Wilson had abided by the terms of the Abbeville Agreement, and the British Army could not provide for the needs of more than 120,000 men, but the French army could absorb the surplus.

General Foch proposed that the American contingents should be increased to 100 divisions and that for this 300,000 Americans should be enlisted monthly.

After a long discussion on American effectives, on the training of reinforcements and the possibilities of tonnage for the month of July,

[1] By the Milner Agreement signed in London on the 24th of April, 1918, by Lord Milner and General Pershing, it was arranged to send to the British army the 120,000 American troops promised.

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the Council studied Mr. Lloyd George's proposal to incorporate the American contingents in the British Army in order to maintain the full complement of British divisions as Foch wished.

In conclusion, the Council decided to send a message to President Wilson stating that "it was estimated that the total of American forces necessary to allow the Allies to obtain a numerical superiority should not be less than 100 divisions.

The Council proposed that following on the agreement concluded between General Foch and Lord Milner for the month of June (namely :—(1) absolute priority for the transport of 170,000 American combatant troops; (2) 20,000 men ear-marked for duty on the railways; (3) the surplus for the American Army) it should be agreed for the month of July: (1) absolute priority for the transport of 140,000 American combatant troops (2) the surplus for the American army (the maximum number transported was supposed to be 250,000 men).

With regard to ammunition and military supplies the Governments accepted the principle of pooling their resources. After this the Council studied other questions wider in their scope and not exclusively of military interest.[1]

It decided to make an official request to Japan to intervene in Eastern Russia under certain conditions.

It decided also :—

(a) To hasten the despatch of Czech troops from Vladivostock, Great Britain being asked to obtain Japanese transports;

(b) To recognise by a solemn declaration the independence of Jugo-Slavia, Czecho-Slovakia and Poland;

(c) To accept the principle of Allied intervention in Northern Russia with unity of commnad.

The seventh sitting was also held at Versailles on the 2nd and 4th of July, 1918.

The struggle continued fierce and violent in France, but decisions had been taken and it was necessary to await results. Only the question of the transport of American reinforcements from the month of August onwards was discussed.

Then the Allied Governments agreed :—

To take steps to persuade President Wilson to accept the principle of Allied intervention in Siberia.

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[1] The following were present at these meetings: France, M. Clemenceau, Prime Minister and Minister for War, M. Pichon, Minister for Foreign Affairs, M. G. Leygues, First Lord of the Admiralty. Generals Foch, Belin, permanent military representative, Weygand, Mordacq and Admiral de Bon; England, Mr. Lloyd George, Prime Minister, Viscount Milner, Secretary of State for War, Mr. Balfour, Secretary of State for Foreign Affairs, Marshal Haig, Generals Wilson, Lawrence and Sackville-West, permanent military representative, Sir Eric Geddes, First Lord of the Admiralty and Admiral Weymss, First Sea Lord; Italy, M. Orlando, Prime Minister, Baron Sonnino, Secretary of State for Foreign Affairs, General di Robilant, permanent military representative and Admiral Thaon di Revel; United States, Mr. Frazier, First Secretary to the United States Embassy at Paris, General Pershing and General Bliss, permanent military representative.

The presence of Ministers from the Admiralty and Admirals was accounted for by one of the questions of the order of the day: "Co-operation of the Italian fleet in the Adriatic," regarding which no decision was taken.

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To increase Allied effectives in the northern ports of Russia. To call on the military representatives to study the possibilities of an offensive in the Balkans which the French were pressing for;

To ask the military representatives to study, in consultation with the Commanders-in-Chief of the Allied armies, a plan of campaign for the period end of 1918 to the beginning of 1919. The eighth meeting of the Supreme War Council only took place several months later, on the 31st of October and the 1st, 2nd and 4th of November, 1918, at Versailles.

From July 18th, General Foch having been able to retake the initiative, had not lost it again, and was conducting his wonderful offensive without a break and with redoubled energy on all parts of the front.

As a result of our offensive in the Balkans, Bulgaria had just surrendered to the Commander-in-Chief of the Allied Armies in the Middle East on the 29th of October, 1918.

Austria-Hungary and Turkey were exhausted. Only Germany was still able to offer a resistance, but she felt that her hour was approaching, and had opened communictaions with the American Government with a view to finding out the Allies' terms.

The Supreme War Council at its eighth meeting only dealt with two questions :—

(1) The conditions of the armistice to be granted to Austria-Hungary.

(2) The conditions of the armistice to be granted to Germany. Turkey surrendered to the British Government, acting in the name of the Allies, on the 31st of October, 1918.

Austria-Hungary accepted the conditions offered to her by the Italian Government in the name of the Allies on the 3rd of November. Germany signed the terms of the armistice offered to her by General Foch on the 11th of November, 1918.

After the armistice had been signed the Supreme War Council continued to exist, and had several sittings at Versailles where the conditions of the Peace Treaty were partly drawn up. It was at Versailles, on the 7th of May, at the Trianon Palace, that the Conditions of the Peace Treaty were handed to the German plenipotentaries; these were accepted and signed on the 28th of June, 1919, in the "Galerie des glaces" at the Chateau of Versailles.

In this manner the prediction which Mr. Lloyd George made at the birth of the Supreme War Council, it being granted that the Council should sit at Versailles, came to be realised.

The special rôle of the permanent military representatives.

The permanent military representatives, created to be the technical advisers of the Supreme War Council, constituted an inter-Allied General Staff, whose headquarters were at the Trianon-Palace at Versailles.

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The first permanent military representatives appointed by the Rapallo Agreement were General Foch for France, General Wilson for Great Britain, and General Cadorna for Italy. But General Foch, who was already Chief of the General Staff, could not combine these two functions.

He was replaced on the 29th of November by General Weygand, who in his turn, on being appointed Chief of the Staff to General Foch —when the latter became Commander-in-Chief of the Allied armies, was replaced temporarily by General Vidalon, and then permanently by General Belin.

General Belin, a Major General at the beginning of the war, remained the French permanent military representative right up to the cessation of hostilities.

Some changes took place, likewise, among the representatives of the Allies during the year 1918.

General Wilson was followed by General Rawlinson and the latter was succeeded by General Sackville West. Generals Giardino, di Robilant and Cavallero succeeded General Cadorna as the Italian permanent military representatives.

When the United States entered the war they sent General Taker Bliss to the Supreme War Council, and he remained the American permanent military representative till the end of the war: he was present for the first time at a meeting of the military representatives on the 29th of January, 1918.

Each permanent military representative had his own Staff.

That of the French representative consisted of a Chief of the Staff[1] and a certain number of officers divided into three sections.

The first section (operations) collected and studied the plans of campaign of the Allies, kept itself informed of the enemy's intentions and considered certain questions which cropped up on the different fronts, such as the resources of the national forces of the Allies and the enemy on those fronts. As the most important section of the Staff it comprised eight officers divided into two sub-sections: West and East.

The second section (economic and diplomatic) kept itself in touch with all economic and political questions which affected the conduct of the war.

The third section (naval) was concerned with information on naval and maritime questions which affected the conduct of the war.

The duty of the permanent military representatives was to keep the Supreme War Council permanently informed of the state of the troops and resources of all kinds at the disposal of the allied as well as of the enemy's armies.

But from the very nature of their constitution as a permanent body they were called up by force of circumstances to see their rôle amplify and their importance increase. They carried out not only the duties entrusted to them, but also, at least in part, those of the Supreme War Council which the latter could not accomplish at its meetings, these not being always held even monthly.

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It was in this manner that they became the executors of the terms of Article II of the Rapallo Agreement: "The Supreme War Council prepares the outline of the Government's decisions, sees that these are carried out and reports to the Governments concerned."

This extension of their rôle was emphasised at the second session in the opening address made by M. Clemenceau: "I beg the permanent military advisers to remember that their task consists in giving advice to the Supreme War Council not as representatives of their respective nations considered separately, but as a collective body. They must study the problems placed before them from the point of view of the Allies as a whole, and not of any one nation considered separately: finally they must present to the Supreme War Council the measures which they recommend in the form of a collective note bearing the signatures of all the representatives."

Thus was made clear to the permanent military representatives not only the spirit in which they should approach the fulfilment of their mission, but also the means by which the result of their labours was to be expressed: The Collective Note.

In conclusion M. Clemenceau proposed that each Government should formally pledge itself to furnish its permanent military representative with all the information which he required for the study of these grave problems.

The military representatives having received all that was necessary for them to be able to act, became the framework, the permanent extension of the Supreme War Council, the instrument by which it acted, and by which its continuity was assured.

That they had the support of their Governments was proved by the decision taken at the third Session at London (the 14th to the 15th of March, 1918) when Mr. Lloyd George said that he thought "there existed a tendency not to wish to recognise the Council of Versailles." The Supreme War Council decided that the Commanders-in-Chief should communicate "all their plans of campaign in detail to the permanent military representatives."

At the preceding session on the 4th of February, 1918, at Versailles, in order to accelerate and simplify the work of the Supreme War Council, Lord Milner had had the following resolution adopted which regulated the procedure of the Collective notes: "The head of each Government represented at the Supreme War Council pledges himself to see that the military representatives of this Council are informed with the least possible delay whether each of the collective notes presented by them have been accepted by his Government, or whether his Government wishes it to be revised with a view to its being discussed at the following meeting of the Supreme War Council. When one of these notes has been accepted by all the Governments concerned it shall be considered from the date of acceptation as a decision of the Supreme War Council."

Further, owing to the fact that from the point of view of the creation of the Supreme War Council the situation had changed in the interval by the nomination of General Foch to the Supreme com-

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mand of the Allied armies on the Western Front, the Supreme War Council in its seventh session (4th of July, 1918,) settled the definite rôle of the permanent military representatives by the following resolution:

"In order to make the greatest use of the services of the permanent military representatives at Versailles in their co-operation with the Supreme War Council, and in order to avoid all confusion between their functions and the duties assigned by the Supreme War Council to General Foch or any other executive authority, the Supreme Council lays down the following proposals:

(1). The military representatives at Versailles are the competent advisers of the Supreme War Council as regards general military policy.

Their task is, as far as the Franco-Anglo-American front is concerned in consultation with General Foch, and as far as the other fronts are concerned in consultation with the Chiefs of Staff and the Commanders-in-Chief, to study the military situation in its widest strategical aspect, taking into account all factors such as: political developments, the naval situation and the question of tonnage, the utilisation of new means in warfare and new methods of tactics, etc. . . . . and to consider how these factors apply to all the actual or possible theatres of war.

(2). The military representatives shall present the results of their study of the situation in the form of a note to the Supreme War Council. These notes may deal with special questions submitted to them by the Supreme War Council or by the Governments, or with any other question which the military representatives consider should be discussed, or with the questions which General Foch Commanding-in-Chief may submit to them. The final decision rests with the Supreme War Council."

The permanent military representatives met to discuss all questions. Their first sitting took place on the 4th of December, 1917. Up to the Armistice they held fifty sittings. Each sitting was presided over by one of the permanent representatives in the order of the entry of his country into the war. The quorum could be obtained, in case of urgency, by three representatives, the fourth being represented by the Chief of his Staff. The Secretary at each sitting belonged to the same nation as the President. The discussions were conducted in French and English, and the minutes written in these two languages. The questions to be debated could be submitted to the permanent military representatives according to one of the following procedures:

(1). The Supreme War Council during the course of its meetings could submit questions to the military representatives who examined them and gave their opinion;

(2). Each military representative could at any time call a meeting to discuss a question submitted to him by his Government;

(3). Each military representative could call a meeting to examine a question which he wished to raise on his own initiative;

(4). On receipt of these requests the order of the day was settled by the Secretary of that day who had to be a compatriot of the President of that sitting.

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At the end of each sitting the collective secretariat agreed upon the wording of a collective note and the resolutions which resulted from it. The wording of these notes was only adopted with the approval of the four permanent military representatives.

Indeed, the latter, in order not to diminish their authority with regard to their Governments, had decided in accordance with what took place in the Supreme War Council, that the collective notes submitted to this Council should express the unanimous opinion of the military representatives of the different Governments and should bear witness to this unanimity by the attachment of their four signatures.

Once drawn up, rendered authentic and signed by the four military representatives, the collective notes, as well as the minutes of the proceedings of the meetings, were communicated to the Governments concerned.

Such were, then, the conditions in which the permanent military representatives could and were expected to fulfil their mission. They fulfilled it by furnishing the Supreme War Council with notes or collective opinions.

Their labours had the following objects in view:

To prepare for the Supreme War Council the outline of its decisions: reports on the plans of campaign for 1918; conditions of an armistice; drafts of the military, naval and air clauses to be inserted in the peace treaties.

To present the Council with their opinion on the situation on any front; Italy, the Balkans, Russia, Caucasus, Mesopotamia: or on the plans of a Commander-in-Chief: the plan of campaign of General Guillanmat.

To place the Council in a position to review the question of effectives: extension of the British front, the American army, Chinese co-operation, Abyssinian labour.

Or questions of tonnage: Holland.

And supply: Pool of ammunition, forage for horses.

In particular their influence made itself felt at the time when the following subjects were being discussed; unity of command, the formation of the general inter-Allied reserve, the creation of an Executive Committee, and above all the offensive undertaken in the Balkans in October 1918, the consequences of which were so instrumental in bringing about the end of the war.

In addition they knew how to profit from the initiative which had been granted them, and they submitted to the Council questions which seemed to them to be important and to which they had been able to find a satisfactory solution. Amongst other things, the creation of the inter-Allied Committees on transportation, aviation and tanks is due to them.

Finally, they assured the execution of the decisions approved by the Supreme War Council, and in order to be able to do this they agreed "to exchange all notifications of decisions as well as the various reports which were received dealing with their execution." Even on this subject, finding that there were so many difficulties and delays

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in getting the Governments to accept their Collective notes, (which did not become the decisions of the Supreme War Council until they had received the approval of each Government), they agreed that it was necessary that they themselves should remind their respective Governments of the importance of coming to a rapid decision.

To sum up, then, we must note that if the permanent military representatives had no power to make decisions on their own, their rôle was in any case not a secondary one, for, considering it in the widest sense, they were not only the advisers of the Supreme War Council, but they also prepared its decisions, suggested a great many of them, and in the case of all those which were approved, saw that they were carried out.

Conclusion.

It is thus that the Supreme War Council fully carried out the services for which it had been brought into being. In this manner it justified the aspirations of its two founders, M. Painlevé who had stated : "If we ever succeed in establishing unity of command, it will be through the exercise and action of this inter-Allied Staff which has just been formed," and Mr. Lloyd George, who had declared : "Now that this Council is established it is for us to act in such a way that the unity which it represents shall be a reality and not a sham."

The Supreme War Council was the first tangible sign by which the desire for union between the Allies manifested itself and became a reality; it owed its creation to the good understanding existing between them and to the wish to make the most of this understanding; it was thanks to this that it survived and that it succeeded in its task.

Instead of being an aulic Council, shunning its responsibilities, it shouldered the heaviest burdens. Although long and difficult discussions were often necessary, it never failed to act and never ceased to show an example of perfect harmony. Each member, in fact, remembered the advice given by M. Clemenceau, to study the problems from the point of view of the Allies as a whole, and not of any one nation considered separately."

For the goal was clear to all and there was a common wish to reach it; it was a question of beating the enemy, of crushing the German Empire.

This result was obtained by the union of all the Allied forces placed under the command of one leader. The greatest claim to glory of the Supreme War Council will be to have prepared and facilitated unity of command.

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THE REGIMENTAL JOURNALS OF THE UNITED STATES ARTILLERY.

BY MAJ.-GENL. SIR J. E. W. HEADLAM, K.B.E., C.B., D.S.O.

STATESMEN on both sides of the Atlantic assure us that a true friendship between the two great English-speaking Nations would be the surest guarantee for the peace of the World; and those who know something of both nations are agreed that the great obstacle to such friendship is mutual *ignorance*. Can not we gunners take our share in breaking down the barrier by getting to know something of our brother-gunners in America? Comparatively few had an opportunity of seeing much of them in France, for their "front" was far from ours, and fewer still have had the good fortune to visit them at home. But America is a country of which much may be learnt by an intelligent study of the Press, and this applies even to their Regimental Journals, which are far more out-spoken, and therefore more illuminating, than our own. Of such journals the United States Artillery maintains two—the "Journal of the United States Artillery" and the "Field Artillery Journal", both of which are well worth our attention. The reason for the duplication is that when the separation between "Coast" and "Field"[1] took place (about the same time as with us) it was complete. The two branches are now separate Corps, each with its own "Chief", and naturally therefore its own Journal.

In appearance the two Journals are markedly dissimilar. That of the Coast Artillery has retained, with the original title of "Journal of the United States Artillery", the severely professional appearance which distinguishes most of such publications the world over, confining its illustrations to a frontispiece, and eschewing advertisements. The Field Artillery Journal on the other hand, unhampered by tradition, makes a frank appeal to the eye. About the size and shape of our Cavalry Journal, its general "get up" is most attractive, paper and print being of the best, and the illustrations quite admirable. In addition to those relating to the articles, of which there are usually several pages,[2] there is always a frontispiece, often a subject of general interest—not long ago it was an excellent reproduction (in colour) of the portrait of General Shrapnel at Woolwich. The advertisements, ranging in subject from a caterpillar tractor to a polo stick, no doubt make such luxuries possible—can not we follow suit?

In addition to these two strictly Artillery Journals there is a third of which mention must be made here, though it bears the title of

[1] In the United States the Field Artillery includes our "Medium."

[2] The photographs of every form of artillery tractor and "self-propelled mount" are of special interest now that the problem of mechanical transport for artillery is so much to the fore.

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"Army Ordnance", for it is really the Journal of what corresponds to our Directorate of Artillery. Its articles, always profusely illustrated, are well worth the attention of all those who are interested in the development of artillery material, but the object with which it has been established is perhaps its most interesting feature. To quote its motto, it is "Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guarantee of Peace." This it is hoped to effect by maintaining the touch between the War Office (there was no Ministry of Munitions in America) and all those who were engaged in the production of munitions during the war, and keeping them up to date in such matters, so that, should the need arise, they may be ready to take up the work again.

The majority of the articles in the two artillery journals are on much the same subjects as those in our own, but there are perhaps more contributions from officers of the other arms, and the difference in the way the subjects are dealt with often "gives one to think." Papers on non-technical subjects—such as "Americanization", that great problem of the solidification of the purposes and outlook of all their mixed population *on the basis of the Anglo-Saxon tradition*— are more frequent, and there are many more extracts from Foreign Journals, English not excepted. In old days our "Proceedings" used to be filled with such translations, but there was an outcry that native talent was being discouraged, and they were banished. As usual the pendulum swung too far. At this time especially, when we are all groping for the true lessons of the War, we can not afford to ignore the experiences of our friends—or of our enemies. And they are often such interesting reading too! The story of a German horse artillery brigade in France, as told by its commander in the Field Artillery Journal, must appeal to any gunner.

But criticism of individual articles is beyond the intention of this paper. Its object is rather to draw attention to those features of American regimental journalism which are most characteristic, and therefore most interesting to those who wish to find in their pages some clue to American mentality. The first thing that will strike such a reader is the freedom with which official matters are treated. Papers which with us would be "confidential" at least, if not "secret", and would probably never be allowed to emerge from the War Office, are issued to the Regimental Journals for the benefit of the officers at large, and what is more, they are discussed. Thus the Report of the Committee assembled in France after the Armistice to lay down the ideal organization and armament for the artillery of the Field Army—obviously a matter of the greatest interest to all—appeared in the Journals, and was followed by articles telling what action was being taken on the recommendations of the Committee! Again the recent re-organization of what corresponds to our Directorate of Artillery was described in the greatest detail, the description including a full explanation of the objects of the Chief of Ordnance in making the changes, and of his policy as regards the relations of his Department with "the Line." A still more striking example of the outspokenness of the

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American Journals, and of the way in which Commanders take their subordinates into their confidence to an extent unknown to us, will be found in the last number of the Journal of the United States Artillery.

In America, as nearer home, shortage of personnel, lack of trained subordinates, ever increasing office work, and, as a last straw, the demands of education, have shorn regimental soldiering of many of its pre-war attractions. There has been a scramble to "get away from troops," to "do anything but straight duty." The Chief of Coast Artillery does not ignore the feeling, nor does he take exception to the grumbles in the pages of the Journal. On the contrary he takes these latter as his text in addressing a personal "Message" to his officers through the same channel. In this he puts the whole position before them, tells them frankly that the transformation from war to peace will demand still further sacrifice on their part, and winds up with an appeal to maintain the traditions and reputation of the Corps. It is a letter well worth reading.

The Annual Essay is a feature of both Artillery Journals which I think I am right in saying they have borrowed from us. The conditions for the most part are practically identical—with the addition of the valuable prizes of $150 and $100—but there is a characteristic development. Instead of being tied down to subject this is *left to the competitor*, with the stipulation only that it should be a serious discussion of "some phase of the work of Coast Artillery affecting its future progress," or of "some timely field artillery subject, or technical field artillery study based on lessons of the world war." It seems worth consideration whether we might not try the experiment. It would no doubt render the task of the judges more difficult, but it would probably make the essays more generally interesting, and it *might* bring some really valuable contributions from men of ideas!

In the above notes on the Journals of the American Artillery I have endeavoured to give a general indication of their scope in the hope of tempting my brother-officers to read them for themselves. I am sure that they will find them instructive as well as entertaining, for the problems of the writers are generally ours, though their solutions may be all their own! Better still if those for whom prohibition has no terrors would spend a leave in the United States—I can promise them a courteous reception and the most kindly hospitality. As President Harding told us the other day—"A common language and the common source from which we have taken our Institutions have laid the foundation of accord." It remains for us to build upon that foundation by getting to know each other better.

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OPERATIONS OF THE HORSE BATTALION 15th (GERMAN) FIELD ARTILLERY, WITH THE 7th CAVALRY DIVISION IN NORTHERN FRANCE AND BELGIUM, AUTUMN, 1914.

BY LIEUTENANT COLONEL SEEGER.*

From Artilleristische Monatshefte, November-December, 1920.

(Reprinted from the U.S. Field Artillery Journal, March—April, 1921.)

ON October 2, 1914, our division was a few kilometres north-east of Bapaume, under orders to move west of Douai and cover the flank of the 1st Bavarian Army Corps, just arrived from Lorraine. We had been reinforced by another cavalry regiment, the 16th Uhlans. The 9th Cavalry Division, just ahead of us, had become engaged near the main Arras-Cambrai road, at Chérisy-sur-Sensée, so that we crossed its rear in a single forced march of about forty kilometres, by Vis-en-Artois, Sailly-en-Ostrevent and Vitry-en-Artois, and reached Quiery-la-Motte late in the afternoon, without seeing anything of the enemy. This last-named place is just west of Douai, whose towers were clearly in sight.

The right flank of the Bavarians had encountered small hostile forces at Izel, two kilometres west of us; farther north, it was reported, Beaumont was held by the enemy, and still farther north all the coal country of Henin-Lietard and Lens. Here, in this region, made so famous in Zola's "Germinal," the next few days saw a series of engagements, which were to determine the fate of this whole country until the end of the war. If our Bavarians, and the cavalry divisions with them had not acted with such speed and decision, we should have lost control of this region, to whose defense strong forces, both French and English, were being concentrated. As it was, we held and used the coal mines until, in the last few weeks of the war, this part of the line had to join in the general withdrawal. For fifty months, German blood never ceased to flow at Lens and on the Loretto hill; and I have never ceased to be proud that my batteries were the first to come into action there.

On the evening of the 2nd the whole division was so worn out that it was decided, to our great joy, that we were not to go in that night, but go into quarters just west of Douai. My battalion was assigned the villages of Brebières and Courchelettes, but had to dispute possession with the 9th Cavalry Division, which arrived about the same time.

* Translated by Colonel O. L. Spaulding, Jr., General Staff, U.S. Army.

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It was not until after a long argument, and delay at headquarters of the Sixth Army at Douai, that our right of priority was recognized.

On the 3rd we entered upon a period of hard and costly fighting, which, for the artillery especially, had the interest of a complete novelty. We had to learn to use our guns singly, in a country where no observation was possible, and where there could be no single control of the artillery according to our previous ideas. The whole country was covered with houses, and one could never tell what village he was in. The French General Staff maps, which we had carefully brought along in the original packages, were of no use; they had slept peacefully for ten or twenty years in our strong boxes, never replaced by new editions. We had never felt so lost in the matter of maps, and were greatly relieved when we finally did get a few copies of the new German map of the region. As a rule, we had no complaint to make about the supply of maps, but the maps themselves were obsolete for many regions, and new ones could not be obtained soon enough. Even at this early period, the demand on our mapping section was enormous.

The division assembled at Quiery on the morning of the 3rd; and now our orders led us into the heart of the black country, where every commander found difficult problems to solve; for even from a church tower there was never anything to be seen but houses, chimneys, and slag-heaps. Any number of the enemy might be hidden here, above and below ground; guerilla warfare and fighting with the inhabitants might readily assume dangerous forms. We had had no experience, either in peace or war, in such a country, so that we had to adjust ourselves very rapidly to new conditions. The first inspiration, of course, was to use the high chimneys and slag-heaps for observation towers. My staff made extensive use of them; some of my officers soon grew very skilful in climbing to high points, with or without ropes or climbing irons, as the case might be.

I remember that on one occasion, when we were relieving the Guard Cavalry Division in this country, the commander of their artillery battalion introduced one of his assistants, Lieutenant Baron von C——, a nephew of our former Chancellor, as "a fine climber—has passed the chimney-sweep examination, and can get up anywhere." And he well deserved his reputation, for he rendered good service not only to his own troops, but to ours. I recommended him to all my officers for imitation in this not overly cleanly occupation, in which the end certainly justifies the means.

In the country just described, called the Borinage, the enemy's patrol and spy system had a rich field; and all sorts of rumors gained circulation, of whole regiments of Moroccans hidden in the shafts to attack us in rear. One man came to us, a coal miner, who said he was a Spaniard and a friend of the Germans. He spoke but little French, and an interpreter was sent for from division headquarters, who conversed with him for a long time in the language of Don Quixote; but he had little of any consequence to tell us. However, he said very rightly that we must be careful, and advance only slowly and with

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proper dispositions for security; that we might find house-to-house fighting at any time.

Our cavalry, with the few guns of my battalion, was to take possession of the factory towns of Hénin-Liétard and Billy-Montigny, which we accomplished by evening after constant fighting in the long village streets. One of my batteries posted two guns at the entrance of the former village, and swept the whole main street, 1500 m. long and perfectly straight, with time shrapnel; at the farther end there was a barricade, with thin smoke rising from behind it. Since all six regiments were attacking at the same time and in different places, to get the towns quickly by envelopment, there was some danger of the troops firing at each other, especially in indirect fire in such places as the numerous crossings of the Deule Canal and of the Souchez. In such country the close connection of fighting troops is even more important than elsewhere, for the difficulties of command are enormous.. It becomes very evident, too, that determined troops attacking boldly do much better against an enemy who is not quite sure of himself than those who doubt or hesitate. During these few days we saw much of both types of leadership; I was always glad when we had to work with regiments whose motto was "nothing venture, nothing win."

The artillery commander had for the most part but little to do, other than to give advice to the separated batteries and bring such unity as possible into their action. Still, toward evening of this eventful day all my batteries got into action together under my own command, against an enemy in plain sight, and with good success. We got orders that the cavalry was to finish the work in the villages alone, with only one of our guns to each of the four regiments engaged; and that the three batteries were to turn their attention west instead of north, to support the action of the Bavarians at the village of Rouvroy. I quickly assembled the battery commanders, and indicated the position and targets. My staff climbed to the top of a still smoking slag-heap; from here we could get excellent observation, and conduct the fire of all three batteries by telephone, utilizing favorable opportunities and the last of the day light. It has always been my custom to take a hand personally in the conduct of fire, when the situation demanded it and there were good targets within my reach which could not be observed by the batteries. Although there is nothing about it in the Regulations, I have often, on proper occasion, taken the firing out of the hands of the battery commanders, and have never been able to see that any harm was done. Of course, this assumes that the battalion commander is skilful in the use of his telephones, aiming circles, telescopes, and all the rest, so as not to display ignorance before his subordinates. I believe this full mastery of our new laying equipment was not then universal in the army, especially in the reserve units and among older officers who had not had recent training. Now, after the war, every artilleryman will agree with me that all the higher officers, including brigade commanders and chiefs of artillery, must know all that his gunners, instrument sergeants and observers know; for he may have

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to depend upon himself alone when his peace-time assistants are killed or wounded.

After this first firing position, we moved to another—at a gallop for the first time of late. We came into action pretty much in the open, to fire a few more rounds by the last of the evening light at the retreating enemy. The instinct to take cover was already well developed in my men, and they brought bundles of straw from the stacks near by, to mask the guns.

"If it does no good, it can't do much harm," remarked one of my battery commanders. It was a constant delight to me to see the interest and energy displayed by the battery and battalion scouts, who were ready with suggestions and comments whenever they felt justified in making them; I always encouraged this, when it was done in good faith. I have already spoken of this, in my article on Lens in January, 1916, which attracted notice in even the enemy's professional journals.

At sunset the successful fight was broken off, and, by the light of the burning buildings, we withdrew for the night to Beaumont, where the whole division, with over 5000 horses, bivouacked together. The bad thing about such a bivouac was that it took nearly all night to water the horses.

The next day we continued with the Bavarians westward toward Méricourt, while Lens and Hénin-Liétard, farther north, were taken by the cavalry and Jägers. This they accomplished by noon. Our dashing 9th Cavalry Division had broken through the enemy's lines at Loison, near Lens, and taken the burden off all the other troops, for they were able to take in reverse the enemy's posts along the Souchez. So progress was rapid toward the north, and the Bavarians occupied Avion, a suburb of Lens. It was evident that there would be more hard fighting here. So we trotted rapidly forward; spurred on by the success of our cavalry, my batteries made a dash for the hill 60, about four kilometres north of Lens, but paid a high price for it. We were too careless, and forgot, what we should have learned already, that the French were masters in retreat. Our observation stations were discovered, and overwhelmed with fire. This was a very common experience everywhere on the west front, during the first few months of the war, as I have often heard from comrades who held commands there. In the east, against the Russians, we could be bolder, and often use open positions, for they were not as skilful with their artillery as our western neighbors.

The day had been a hard one, and the 5th was to be just as hard. Still we had been successful, and had made progress westward, through the skilful use of the numerous bodies of cavalry and the energy of the Bavarians. Lens and all its suburbs were completely in our hands. For the night we were quartered in Billy - Montigny, a large straggling town which had at last been cleared of the enemy. It was very hard to get our bearings in the factory districts, and keep our men ready for emergencies in their scattered quarters. Sometimes, when it seemed necessary, whole batteries or squadrons would be put into deserted factories; but it was not easy to care for the horses there. We were almost too careful of them at that time; quite the

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contrary to the practice on the eastern front, where much less consideration was given them.

For October 5th, the 7th Cavalry Division was ordered to march upon Camblain l'Abbé, by way of Liévin, Angres, Souchez and Ablain. We never reached there, however, in the whole war; there was constant bitter fighting at Ablain, Souchez and Carency, with losses almost as heavy as at Verdun and on the Somme.

The division assembled early in the morning at Sallaumines, head of column in the centre of the town, close by the monument erected by the French Government in memory of the miners lost in an accident a few years before at Courrières. Suggestive of the feeling in France toward Germany just before the war is the circumstance that on this monument there is not a word of acknowledgment that the survivors of this accident owed their lives chiefly to the humane action of our emperor and to the promptness of the German relief expedition!

The march through Lens, with its interminable suburbs, was torture to our horses. Their shoes were about worn out, and so thin and smooth that on this slippery ground we had to dismount and lead the horses; even so, they often fell, and our progress was slow. When we finally got through Liévin, the western suburb, we heard the sound of guns just ahead; we were again in contact with the enemy.

There was a long halt, headquarters trying to decide what to do. Officers' patrols of the leading Bavarian division were on the Loretto hill, at whose foot we were halted. I discussed with my battery commanders the routes to be used if we had to go on to the hill, which seemed highly probable, especially since behind Souchez hostile troops had been encountered, who withdrew rapidly. They were French cavalry and artillery; English troops also were reported, coming up from Bethune toward Aix-Noulette.

I asked permission of the division to ride up on to the commanding Loretto hill to get a view of the country. With a few men of my staff, I galloped up the west slope to the churchyard, where we dismounted behind the wall, according to our old habit, to creep closer. The experiences of the day before had made us cautious; my own nerves were a bit shaken, but it was necessary to hide any such feelings. Still, I expected at any moment to see the familiar black bursts of the French shells. Sooner than I expected, they came. While we were riding up the hill a Bavarian officer had met us and asked us to get some batteries on the hill as soon as possible; he said the enemy were retreating in disorder, and the first few cannon shots would completely disorganize them. I pointed out to him that patrols had showed themselves too carelessly on this conspicuous hill, and given indications of the presence of some headquarters. He answered laughingly, "This retreating mass can not possibly make any resistance; just get some guns up here quickly and open fire." As answer to this unduly optimistic suggestion, just then came two shells, almost perfectly adjusted in direction and range, and burst hardly ten paces from the bench, which, close to the chapel and between two trees, stood out in clear view of all the country round about.

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My first thought was, "Here's what comes of too much optimism." Everyone ran back behind the crest, to find cover or get away altogether; the latter seemed best, for I knew that we should now get volley after volley, as we actually did. I called to my men to lead the horses a little down the hill, so that we could mount more readily, and ran back toward them. But already the volleys were coming in quick succession, and sweeping the whole hilltop.. One struck close to me, in a group of hurrying horses and men; wounded horses broke loose and galloped down the hill; men and horses lay groaning on the ground. There was nothing to do but get away as quickly as possible, for there was no cover anywhere near. It was lucky for me that my horse Hans was not afraid of the heaviest fire, whether he stood near our own guns in action or shells were falling near him; he only laid his ears back and crouched a little, when they came too close. Such moments as this will always remain in our memories; it was a question of fractions of a second, whether we should get safely away or join our comrades on the ground. One leap, and I was in the saddle; my adjutant was beside me; what became of the others I could not tell. Even against our will, we went down the hill at a wild gallop; the horses themselves knew what was going on. Beside us galloped two wounded cavalry horses from the cavalry division headquarters. All the horses were so excited that it took us a long time to get out of the dangerous area and get control of them again; we could not stop them until we were clear back to the highway. The two wounded horses had disappeared by this time. And as ill luck would have it, just at this time our commanding general, von der Marwitz, appeared, coming up the road in his car, not realizing the danger he would be in if the hostile artillery happened to sweep a little more deeply.

I informed him briefly as to the situation, and my dispositions for going into position here. The one clearly marked point of the long ridge had to be eliminated from consideration, and the batteries must make a careful reconnaissance and then go into position with wide intervals. But I shall never forget the well-meant suggestion which our highest cavalry commander thought it his duty to make to me in this particular situation; he remarked that I should establish my battalion station at the chapel! I told him what had just happened there, and said that I had no idea of suicide, for the chapel would soon be a heap of ruins. And a short time afterwards, as the photographs taken in May, 1915, show, there was not one stone left upon another.

It was early afternoon before we finally got the three batteries into position, with wide intervals, on the ridge, perhaps a kilometre long. We had to take the utmost care, for we knew it was all up with us if anything should betray our position. And from the front, there was nothing exposed, neither guns nor observation stations; but the enemy's patrols and observers must have been busy in our flanks and rear. The two days that we spent on this hill were most memorable for the constant fire in flanks and even in rear, from all directions. We learned during the war to take fire from the front as perfectly

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natural, and to get along with flank fire if it was not altogether too much in flank; but we never could reconcile ourselves to being fired into from the rear without being able to protect ourselves or change position. Our exposed position here was due to the rapid advance of the German troops at this one point, while the attack was held up elsewhere. The hostile batteries thus got an opportunity to fire into our rear at long range.

The enemy, who had fallen back in the morning in considerable bodies of cavalry, seemed to have taken position at St. Eloi and brought a battery into position. We could see his observers on the broad platform of the church tower, while our Bavarian infantry was trying to get possession of Carency and Villers-aux-Bois. But the attack failed along the whole line; reports soon began to come in from all my observers that the enemy was growing stronger everywhere, both in our front and on our right flank at the Bois de Bouvigny on the Loretto ridge. We could distinguish the khaki of the English troops, whom we now for the first time encountered fighting shoulder to shoulder with the more conspicuously uniformed French—which indicated that the enemy was bringing everything that could be spared from other fronts. During these early days of October the English were being withdrawn from the Aisne front, to which the earlier exigencies of the campaign had brought them. Now, when the front was becoming stabilized from Paris to Belfort, they were trying to get clear of the French front, and, as Marshal French's report puts it, "Draw nearer to the threatened coast front," and so more directly protect their own country. From now on to the end of the year, the troops that we met on the Flanders front were chiefly English; and we very soon realized that their infantry was much better trained than the second line troops that the French had put in against us. We felt this especially about the middle of the month, when our cavalry divisions came in close contact with the best of the British troops.

But now, on the Loretto ridge, our cavalry had its first experience in serious dismounted fighting, attached to the infantry. I shall never forget their long faces; they had occasionally done a little dismounted skirmisher work, but limited to reconnaissance and delaying action. But now it was a question of serious attacks on foot, on a large scale; squadron and regimental commanders had to dismount and take their places in the line, and they did not all like it. Our Jägers, who had been doing most of the infantry work for us, had been sent elsewhere. So everyone was happy when the chief of staff of the Bavarian division finally said, "We will take over from the cavalry for the attack upon Gouy; they are hardly equal to dismounted work on that scale." They were ready and willing to take position now and then on foot, and even to hold it firmly, but had never been trained, either in peace or war, for a part in an important infantry attack. Besides, the carbine strength was always very small; a cavalry regiment could hardly put more men in line than a single full infantry company.

By October 6th our position on the exposed Loretto ridge was clearly untenable; we were exposed to flank and reverse fire, as already

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described, and the guns were directly threatened in case of an attack from the Bois de Bouvigny on the right. My battalion was therefore ordered that afternoon to move to the ridge of Givenchy-en-Gohelle, a little farther east, which later became famous under the name of Vimy Ridge. We had to make this change by daylight, and in the face of a watchful enemy, across fairly open ground; for even with long detours there was little cover to be found. I watched with great anxiety the arrival of the batteries, to which I had given orders simply to move as cautiously as possible and one gun at a time up the open slope of Vimy Ridge. For a wonder, they reached their new positions without being fired upon, or at least without losses, but were there again fired upon almost immediately.

From here we fired upon the more distant parts of the Loretto ridge, especially the eastern edge of the Bois de Bouvigny, from which the enemy seemed to intend to roll up our flank. We saw a Bavarian artillery battalion, which had taken position unskilfully on the slope of the Loretto ridge, overwhelmed by a sudden violent burst of fire, which exploded the ammunition baskets and drove the men behind the hill. The battalion commander told me later that his men were newly arrived, insufficiently trained, and equipped only with the old laying apparatus.

The situation that night was critical, for we constantly expected an attack by the enemy, who was being strongly reinforced. Everyone was nervous, and there was little rest. However, the news reached us that we were to be relieved, or at last reinforced, which improved our spirits somewhat. It was said that in view of the existing situation before Antwerp we must expect a serious attack, and must hold for several days. On the morning of October 7th, when we went for orders to division headquarters at Givenchy-en-Gohelle, the news was passing along our lines that Antwerp had fallen. This later proved to have been a little premature; nevertheless, there was an improvised celebration at division headquarters, in a peaceful garden surrounded by the roar of battle. When the division commander pointed out the importance of the capture of the fortress, our joy knew no bounds. Again we thought that the war was nearly over, as we had already thought several times. We had as yet no idea of the consequences of the battle of the Marne; still less did we dream that the war would last over four years and that we should lose.

But our joy was short lived. Just at the third glass of champagne, two shells burst close by in the garden, and killed some horses grazing there. No one could imagine how we had been discovered, under the thick trees; some suggested treachery or espionage, or perhaps the famous underground telephone, which served to explain everything otherwise unaccountable. But our party broke up instantly, division headquarters moved and we others went back to our troops.

On my return, I found that one of my batteries, to celebrate the fall of Antwerp properly, had set fire to the chateau of Noulette, which had been recognized as a hostile headquarters on the Loretto ridge. Our advanced observers had reported by telephone that there was a

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great deal of automobile traffic there, and that flags were visible, indicating the presence of a considerable headquarters. Before long, the whole chateau was burning; indicating, at least, that our shells did have some incendiary effect, which had been considered doubtful in peace time experiments. Unfortunately, we could get no other information as to the effect of our fire. Before very long, there was not a village left in this whole country, not a building to furnish shelter, or a wood to give cover.

Finally, on the 8th, came the long-expected order for our relief by the 7th Army Corps, which was moving by forced marches from the Aisne, to strengthen our lines here and to free the cavalry masses for use farther north. We were directed to turn over our positions to the Westphalian batteries in good condition, and wherever possible with all telephone lines and equipment, as later became the rule. Of course, everyone tried in every way to get newer and better equipment in place of the old, but generally this was out of the question.

We exchanged experiences hastily with our friends in the newly arriving regiments, and moved off, with the comfortable feeling of having accomplished something, to see what came next. The division assembled at Liévin, and after some hours' waiting it was decided to make this a rest-day. This was particularly desirable, as giving an opportunity to attend to our badly neglected shoeing. There had been several attacks by hostile airplanes, causing considerable loss in our division; a single squadron had lost thirty horses and several officers and men. There had even been some signs of panic, as was not surprising in the case of troops who can not quickly take cover, like infantry, and whose long columns on the roads offer a fine target to the enemy's aircraft.

We took quarters in and about Lens, already crowded with German troops, keeping ourselves on the alert so as to move promptly to any threatened point. Hostile shells occasionally fell in the city, for the enemy was very near, and seemed to contemplate retaking the place.

The division assembled at Méricourt on the morning of October 9th. Taught by experience, we were to avoid losses by marching in separate small columns and reassembling to fight. Our task for the next few days was to get possession of Lille, before the French and English could seize it. It was held by only a very small garrison, and a dash for it was well worth trying. A detachment, chiefly of Saxons, was approaching it by forced marches from the east, and all available cavalry divisions were to close in from the south and west. The day was fortunately misty; and we moved out at a trot, in good spirits, ready for anything that we might find at Lille—a city which proved, almost to the end of the war, to be one of the most important places in the occupied territory.

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

Journal of U.S. Artillery.—August, 1921.

Tactical Organisation and Employment of Anti-Aircraft Searchlights. Maj. John S. Pratt, C.A.C. (A 67 page article including a General discussion of Anti-Aircraft Defence).

Belgium.

Bulletin belge des Sciences Militaires.—Sept., 1921.

I. The effect of the resistance of Liège. Col. A. E. M. Fastrez.
II. Indoor Ranging.
III. The Air Force in England.
IV. Modern Searchlights (1). Maj. A. Pirot.
V. Notes on armoured cars (continued). Capt. Comdt. Vander Donckt.
VI. Gas Warfare. Dr. de Sillevaerts.
VII. Aviation and the Navy.
VIII. The development of the Heavy Artillery during the war. (Traces the changes in the Belgian Heavy Artillery up to its present organisation).
IX. Flame throwers.
X. Notes on Foreign Armies.

Amongst Books reviewed is General von Kuhl's "French and English criticisms on the conduct of the world war." (Mittler & Sohn, Berlin).

France.

Revue Militaire Générale.—August, 1921.

I. The organisation of black troops. Capt. L. Mérat.
II. Intelligence—Liaison. Maj. de Cossé Brissac.
III. A French Division at the Chemin des Dames (27 May, 1918). Capt. du Fay.
IV. On the New Army, and the Service of one year.

Revue d'Artillerie.

The articles which appeared in this magazine under the heading "German and Austrian High Power Guns" have been collated and produced by Messrs. Berger-Levrault, Nancy—Paris—Strasbourg in book form. It is a very instructive book with over 100 illustrations in the text, and six plates. It is called "Matériels Allemands et Autrichiens a Grande Puissance." Price 7½ Francs. A copy has been presented to the R.A. Institution and is available on loan.

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Switzerland.

Revue Militaire Suisse.—August, 1921.

I. The progress of present day military Literature in France.
II. The fate of a great army—Notes from Hungary. Capt. Cuno Hofer.
III. Swiss, Belgian and French Notes.

GIFTS AND PURCHASES DURING THE MONTHS OF AUGUST AND SEPTEMBER, 1921.

Books Presented.

By The Secretary, War Office.

The Army Act (Annual) 1921.

By C. E. Doran, Esq., (Nephew of Col. J. R. Magrath, late Madras Arty.)

List of Officers, Bengal Artillery. Stubbs.
List of Officers, Madras Artillery. Leslie.
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REGIMENTAL LIST. The following Postings have occurred during the period 16th August, to 20th September, 1921.

Postings.—R.H. and R.F.A.

Allardyce, Lt.-Col. J. G. B., C.M.G., D.S.O., from 4th Bde. R.H.A., to I. Res. Bde. 16/9/21.
Andrews, Lieut. P. F., from Remount Depôt, Mespot., to Att. 26th Bty. R.F.A. 9/9/21.
Archdale, Major A. Q., from Staff, to Att. IV. Res Bde. 26/8/21.
Bates, Capt. A. G., D.S.O., M.C., from Staff, to 144th Bty., Bulford. 15/9/21.
Beddington, Lieut. H. L. V., from "A" Bty. R.H.A., to "A" Bty. Ammn. Col. R.H.A. 9/9/21.
Bittlestone, Major K. G., D.S.O., from T.F., to 50th Bty. 19/8/21.
Bowring, Lieut. J. R. from 10th Bde. (Repat. P. of W.), to Att. IV. Res. Bde. 23/7/21.
Browne, Lt.-Col. E. W., from unposted, to II. Res. Bde. 31/8/21.
Brown, Lieut. A. E. L., from Att. D.G.R. & E., France, to Att. Royal Corps of Signals, Maresfield. 31/8/21.
Cadell, Major C. A. E., M.C., from 109th Bty., India, to 107th Bty., India. 16/8/21.
Cairness, Lieut. F. H., M.C., from 15th Bty., Newbridge, to 12th Bty., Bulford. 1/9/21.
Carkeet-James, 2nd Lt. C. A., from 8th Bde. Deepcut, to R.F.A. India. 14/9/21.
Chilton, Capt. T. C., M.C., from 76th Bty. Deepcut, to R.F.A., India. 6/9/21.
Currie, Lieut. J. C., M.C., from "A" Bty. Ammn. Col., R.H.A., to "A" Bty., R.H.A. 9/9/21.
Dannatt, Lieut. A., M.C., M.M., from 6th Bde., Ewshott, to R.F.A., India. 14/9/21.
Darling, Lieut. E., M.C., from 7th Bde. Larkhill, to R.F.A., India. 17/9/21.
Esmond-White, Major J., from Att. 15th Bde., to V. Res. Bde. 19/8/21.
Fane, Lieut. H. W. N., from V. Res. Bde., Woolwich, to 91st Bty., Woolwich. 1/9/21.
Gardiner, 2nd Lt. R., from 15th Bde. Bulford, to R.F.A., India. 14/9/21.
Godfrey, 2nd Lt. A. F. H., from 3rd Bde. R.F.A., Rhine, to 18th Bty. 16/9/21.
Gordon, Lieut. A. W. K., M.C., from 8th Bde., Deepcut, to R.F.A., India. 14/9/21.
Gray, Lt.-Col. W. K., D.S.O., from 107th Bty., to 22nd Bde. 7/8/21.
Harvey, Capt. H. le F. F., M.C., from Staff, to R.F.A., India. 15/9/21.
Hill, Major, C. R., D.S.O., from unposted, to 12th Bty. 22/8/21.
Holme, Lieut. P. C., from 19th Bde., to 17th Bde. 16/5/21.
Holmes, Lieut. L. G., from "C" Bty., R.H.A., to "D" Bty. R.H.A. 30/7/21.
Hurd, Lieut. W., from 19th Bde., to III. Res. Bde. 26/8/21.
Huttenbach, Capt. N. H., D.S.O., M.C., from R.H.A. Depôt, Woolwich, to "F" Bty., R.H.A., Canterbury. 5/9/21.
Ingram, Lt.-Col. J. M., D.S.O., from Staff, to Att. IV. Res. Bde. 22/8/21.
Jackson, Capt. E. H. P., from "F" Bty. R.H.A., Canterbury, to R.H.A. Depôt, Woolwich. 5/9/21.
Lewis, Lieut. V., from Mesopotamia, to 31st Bde., Cahir. 6/9/21.
Milne-Thomson, Lieut. M. M., from 126th Bty., to 19th Bty. 26/8/21.
Myburgh, Capt. P. S., D.S.O., M.C., from Staff, to R.F.A., India. 16/9/21.
Neville, 2nd Lt. R. D., from 3rd Bde., Rhine, to 75th Bty. 16/9/21.
Perceval, Capt. C. P. W., D.S.O., from Adjt., 4th Bde. R.H.A., Newbridge, to "I" Bty. R.H.A., Newbridge. 16/9/21.
Potter, Lieut. N. A. R., from 16th Bde., Woolwich, to Att. Royal Corps of Signals, Maresfield. 15/9/21.
Price-Williams, Capt. H., D.S.O., M.C., from Staff, to 76th Bty., Deepcut. 6/9/21.
Renouf, Lieut. G., from 4th Bde. R.H.A., to H.Q., 3rd Bde., R.H.A. 25/8/21.
Roantree, Lieut. F. F. D., from 14th Bde., Colchester, to R.F.A., India. 14/9/21.
Scott, Lieut. A. C., from IV. Res. Bde., Woolwich, to R.F.A., India. 14/9/21.
Shoosmith, 2nd Lt. S. N., from 9th Bde., Deepcut, to R.F.A., India. 14/9/21.
Snook, Lieut. R. J. B., from 8th Bty., Woolwich, to R.F.A., India. 14/9/21.
Stackpoole, Lieut. R. H., M.C., from 91st Bty., Woolwich, to 15th Bty., Newbridge. 16/9/21.
Stebbing, Major N. A., D.S.O., from 79th Bty., Ewshott, to 140th Bty., Woolwich. 16/9/21.

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Postings, R.H. & R.F.A.—*Continued.*

Stillwell, Lt.-Col. W. D., D.S.O., from IV. Res. Bde., to 33rd Bde. 21/7/21.
Twistleton-Wykeham-Fiennes, Major N. I. E., D.S.O., from 78th Bty., Norwich, to Comd., 6th (Kent) A.F.A. Bde., T.F. 8/9/21.
Way, 2nd Lt. A. B. M., from 12th Bde., Aldershot, to R.F.A., India. 14/9/21.
Way, Lieut. J. D., from 119th Bty., India, to 1 D.A.C., India. 16/9/21.
Watson, Lieut. N. V., from 35th Bty., India, to 119th Bty., India. 29/8/21.
Welchman, Capt. G. de V., O.B.E., from 63rd Bty., to Adjt., 5th Bde. 11/6/21.
Williamson, Maj. H. N. H., D.S.O., M.C., from Att. I. Res. Bde., to 17th Bde. 26/8/21.
Wilmer, Major (Bt. Lt.-Col.) E. R. G., D.S.O., from Staff, to 78th Bty. 19/8/21.

Cancellation of Postings.

The posting of Lieut. A. J. Gee to 18th Bty. R.F.A., from Att. Irish Command. 8/8/21.
The posting of Capt. H. le F. F. Harvey to VI. Res. Bde., from Staff. 24/8/21.
The posting of Lt.-Col. G. L. Popham, D.S.O., to India, from IV. Res. Bde. R.F.A. 23/8/21.

Postings.—Royal Garrison Artillery.

Appleton, Lieut. G. L., from 2nd Bty., to Att. 3rd Bde. 25/8/21.
Aslett, Lieut. R. A., from Staff, to Milford Haven. 26/8/21.
Borthwick, Lieut. H. G. E., from H.Q., 1st Bde., Malta, to 2nd Bty., Malta. 14/9/21.
Carew, Capt. R. L. O., from Pack Arty. Depôt, India, to R.G.A., Plymouth. 3/9/21.
Clover, Lieut. W. R. F., M.C., from 1st Bty. R.G.A., Malta, to Att. R.A.F., Egypt. 14/9/21.
Coe, Major J., from T.F., to Att. H.Q., Irish Command. 5/7/21.
Dance, Capt. H. B., from 2nd Bty. Malta, to Adjt., 4th Bde., for India. 1/9/21.
Dowman, Lieut. J. P. G., from 15th Pack Arty. Bty., Egypt, to 1st Pack Arty. Bty., Egypt. 14/9/21.
Dutton, Major R. M. L., O.B.E., M.C., from 35th Bty., to 1st Bty. 19/8/21.
Dutton, Major R. M. L., O.B.E., M.C., from 1st Pack Arty. Bty., Bulford, to Adjt., 1st Pack Arty. Bde. 3/9/21.
Eliot, Major (Bt. Lt.-Col.) N., C.B.E., from Staff, War Office, to R.G.A., Ceylon. 20/9/21.
Hardcastle, Lt.-Col. E. L., D.S.O., from H.Q. & D.E., Clyde, to 9th Bde., Bordon. 9/9/21.
Hayes-Sadler, Major J., from unposted, to Thames & Medway R.G.A., Sheerness. 16/9/21.
Hebert, Major A., from R.G.A. Thames & Medway, to Pack Arty. (unposted) India. 14/9/21.
Hillyard, Lieut. C. A. C., from 2nd Bty., Malta, to Att. R.G.A., Malta. 14/9/21.
Holden, Capt. W. C., D.S.O., M.C., from G.S. Course, to Att. 10th Bde., Larkhill. 16/9/21.
Hourihane, Lieut. P. J., from 7th Pack Arty. Bty., to 1st Pack Arty. Bty. 19/8/21.
Kaye, Lieut. J. W., from 15th Bty., to 1st Pack Arty. Bty. 19/8/21.
Kirby, Major H. A., D.S.O., M.C., from Adjt., 1st Pack Arty. Bde., Bulford, to 1st Pack Arty. Bty., Bulford. 3/9/21.
Leigh, Capt. J. A., M.C., from Staff, to 11th Bty. 8/7/21.
Lushington, Capt. F., from 7th Pack Arty. Bty., to 1st Pack Arty. Bty. 19/8/21.
MacMahon, Major G. P. R., from "G" Coast Bty., to 13th Bty. 18/8/21.
McIver, Capt. K. I., D.S.O., M.C., from Adjt., 4th Bde., Shoeburyness, to 2nd Bty., Shoeburyness. 1/9/21.
Meredith, Capt. J. C., D.S.O., from 47th Pack Arty. Bty., India, to Frontier Garrison Arty., India. 21/7/21.
Mucklow, Capt. C., from G.H.Q., Irish Comd., to R.G.A., Bermuda. 3/9/21.
Peters, Lieut. J., D.C.M., from I. Res. Bde., to Att. Irish Command. 24/8/21.
Preston, Major (Bt. Lt.-Col.) P. H. H., from 1st Pack Arty. Bty., Bulford, to "H" Coast Bty., Portsmouth. 3/9/21.
Prior, Lieut. (D.O.) W. F., from Malta, to Dover. 20/8/21.
Richey, Lt.-Col. F. W., from 3rd Pack Arty. Bde., to Clyde Defences. 26/8/21.
Ross, Major C., O.B.E., from Plymouth, to Malta. 30/8/21.
Rycroft, Lieut. (D.O.) A., M.B.E., from R.G.A., Sheerness, to R.G.A., Malta. 16/9/21.

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R.G.A. Postings.—*Continued.*

Savill, Lieut. L. V., from Att. Sch. of Arty., to "G" Coast Bty. 25/8/21.
Stevenson, Capt. J. H. M., M.C., from 1st Pack Arty. Bty., to 7th Pack Arty. Bty. 19/8/21.
Sutton, Major F., D.S.O., from Plymouth, to 15th Bty. 18/8/21.
Symonds, 2nd Lieut. E. N. C., M.C., on 1st appointment, to Thames & Medway. 29/8/21.
Taylor, Lieut. W. A., from I. Res. Bde., to R.G.A., Bermuda. 3/9/21.
Watkinson, Lieut. G. L., from 47th Pack Arty. Bty., India, to 24th Pack Arty. Bty., India. 1/7/21.
Wilkinson, Lieut. E. G. R., from 15th Pack Arty. Bty., Palestine, to Transit Camp, Alexandria. 22/8/21.

Staff Appointments.

Royal Artillery.

Harding-Newman, Col. E., C.M.G., D.S.O., Col. Comdt., R.A. Southern Comd., India.
Mackenzie, Col. G. B., C.B., C.M.G., D.S.O., Col., R.A. Scottish Command.
Phipps, Col. C. F., D.S.O., Col., R.A. Hd. Qrs., Irish Command. 21/8/21.
Walshe, Col. F. W. H., C.M.G., D.S.O., A.-D.-C., C.R.A., 56th (London) Divn., T.F.
Willis, Maj.-Genl. E. H., C.B., C.M.G., Maj.-Genl., R.A. Hd. Qrs., India.

Royal Horse and Royal Field Artillery.

Bankart, Lieut. C. R., Special Employ, Rhine Army. 23/8/21.
Barter, 2nd Lt. A. R., Appointed Cypher Officer.
Benbow, Lieut. E. W., Appointed to King's African Rifles.
Blood, Lieut. J. N., Att. Indian Ordnance Dept. 2/9/21.
Butler, Lieut. A. E., Cipher Officer, Dublin. 29/8/21.
Claxton, Lieut. F. A., Appointed to W.A.F.A. 24/8/21.
Cooke, Lieut. R. G., Garr. Adjt., Constantinople, and Local Captain. 19/7/21.
Cooper, Lieut. C. H., Appointed to King's African Rifles.
Cornwall, Major (Bt. Lt.-Col.) J. H. M., C.B.E., D.S.O., M.C., Special Serv. Officer, Black Sea. 9/8/21.
Devenish, Lieut. C. O. L., Employed with Arab and Kurd Levies, Mesopotamia. 25/7/21.
Dick, Lieut. J. D. H., Special Appt. Graded Class F.F. and Temp. Capt. 13/1/21.
Duncan, Lieut. M., Seconded to Royal Corps of Signals. 28/6/20.
Edge, Lieut. B. B., Intelligence Officer, Rhine. 22/7/21
Ealand, Lieut. V. F., Adjt., Indian Defence Force.
Fayle, Major D. B. W., M.C., Adjt., 80th Lowland Bde. R.F.A., T.F. 15/8/21.
Fisher, Capt. C. L., Att. Tank Corps. 23/8/21.
Fouracres, Lieut. C. E., Intelligence Corps, Graded F.F., Egypt. 29/6/21.
Giffard, Major J., O.B.E., Adjt., 8th Bucks. & Berks. A.F.A. Bde., T.F. 1/8/21.
Gordon, Lieut. D. N., Special Appt., Class F.F., Temp. Capt. 6/1/21.
Hayes, Capt. H. G., Att. Indian Ordnance Dept. 17/7/21.
Hayward, Lieut. J. L., Seconded to R.A.F. 18/7/21.
Herbage, Lieut. K. A., Seconded under Colonial Office. 29/6/21.
Hugo, Lieut. J. M., Instructor, Equitation School, Ambala.
James, Lieut. G. J., M.M., Garrison Adjt., Ismailia. 25/7/21.
Kemble, Lt.-Col. F. A., Chief Ordnance Officer, Kirkee. 9/8/21.
King, Lieut. H. F. S., Seconded to Royal Corps of Signals. 1/7/21.
Leather, Lieut. J. H., Special Employ., Rhine Army. 10/8/21.
Lewis, Lieut. K. F. McK., M.C., A.-D.-C. to G.O.C., British Upper Silesian Force. 29/5/21.
Lucas, Lieut. R. H. A., Att. G.H.Q., Egypt. 26/7/21.
Mason-MacFarlane, Capt. F. N., M.C., G.S.O., 3rd Grade, India.
Maurice-Jones, Lieut. K. W., D.S.O., Sec. to King's African Rifles. 29/10/20.
McLeod, Major T., Bde. Maj. R.A., 50th (Northumbrian) Div., T.F. 22/7/21.
Moir, Capt. M. E., D.S.O., Coy. Officer Class "A," Royal Military Academy. 3/9/21.
Nichols, Lieut. C. E., Censor Officer, Curragh. 27/7/21.
Patterson, Lieut. L., M.C., Special Appointment, Class G.G. 3/1/21.
Paul, Bt. Lt.-Col. W. R., C.B.E., D.A.D.A., War Office.
Pearce, Lieut. E. M., Appointed R.T.O., Kantara. 5/9/21.
Rawlins, Bt. Col. S. W. H., C.M.G., D.S.O., Commandant, Chemical Warfare Exptl. Station, Porton.

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Staff Appointments.—*Continued.*

Schwabe, Lieut. A. G. T., Intelligence Officer, Grade G.G., Egypt. 6/6/21.
Stanford, Major J., Interpreter, I.A.C. Control, Breslau. 19/9/21.
Stewart, Lieut. J., M.C., A.-D.-C. to G.O.C., Palestine. 12/5/21.
Thompson, Bt. Col. R. H. D., C.M.G., D.S.O., Asst. Comdt. (G.S.O., 1st Grade), Royal Military Academy. 31/8/21.
Williams, Lieut. S., Somaliland Camel Corps.
Willoughby-Osborne, Major D'A., D.S.O., Senior Inspector, Danger Buildings. 1/7/19.
Wisely, Capt. G. L. K., M.C., Intelligence Officer, G.H.Q., Rhine. 1/6/21.

Royal Garrison Artillery.

Carey, Major J. L. R., Adjt., Royal Jersey Militia.
Clayton, Capt. I. N., G.S.O., Arab Army, Mespot.
Cook, Lieut. R. W. H., Seconded to R.A.F. 27/7/21.
Gilkes, Lieut. G. H., Special Appt., Class F.F., and Temp. Capt. 1/10/20.
Gilpin, Capt. W. J., M.C., Staff Capt., No. II. District. 29/7/21.
Gleeson, Lieut. F., Intelligence Officer, Mespot.
Goodwin, Lieut. E. A., Cipher Officer, Ireland. 7/2/21.
Hall, Lieut. E. G. F., Seconded to R.A.F. 7/9/21.
Harler, Lieut. F. C., Intelligence Officer, 6th Divn. 9/8/21.
Lyons, Lieut. J. M., M.C., Attd. D.A.D.R.T., Palestine. 25/8/21.
Marindin, Major (Bt. Lt.-Col.) C. C., C.B.E., D.S.O., G.S.O., 1st Grade, Upper Silesian Force. 13/8/21.
Murphy, Capt. F. C., M.C., G.S.O., 3, Irish Command. 9/5/21.
Sanders, Capt. B. J. M., M.C., Attd. Indian Ordnance Dept. 24/8/21.
Smith, Lieut. I. V. R., Att. Indian Ordnance Dept. 24/8/21.
Stalkart, Lieut. C. M. B., Cipher Officer, Mespot. 7/9/21.
Villiers, Capt. G., M.C., Att. Transit Camp, Alexandria. 25/8/21.
Underhill, Lieut. H. W., G.S.O., 3rd Grade, Western Command, India. 6/6/21.
Underwood, Lieut. E. E., Adjt., Indian Defence Force, Rangoon. 16/11/20.
Williams, Capt. F. P. J., Att. Indian Ordnance Dept. 19/7/21.
Woods, Lt.-Col. G. G., Dep. Dir. Ord. Serv., Northern Command, India. 9/8/21.

REGIMENTAL LIST. The following Casualties have taken place from 16th August, to 20th September, 1921.

First Appointment.

Symonds, 2nd Lieut. E. N. C., R.G.A. (University Candidate from Lieut. R.F.A. T.F.) 27/8/21. With seniority, 3/8/16.

First Appointment antedated.

Kerrison, Lieut. R. G., Commission antedated with seniority to 19/6/15.

Promotions. (Regimental).

Broadhurst, G. S., Promoted District Officer (Lieut.) from W.O. 1/7/21.
Gardner, Major W. H., O.B.E., to be Lt.-Col. R.G.A. 1/5/21.
Riccard, Major J. S., O.B.E., To be Lieut.-Col. R.G.A. 1/5/21.
Spalding, Major W. B., O.B.E., to be Lieut.-Col. R.G.A. 1/5/21.
Scott, 2nd Lt. L. M., to be Lieut. R.F.A. 17/7/21.
Thomas, Major C. S. W., to be Lieut.-Col. R.G.A. 1/5/21.
Walker, Major W. B., to be Lt.-Col. R.G.A. 21/2/21.
Wilkes, Major G. S., to be Lieut.-Col. R.G.A. 1/5/21.

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Promotions. (Other than Regimental).

Bullen, Lt.-Col. S. D., D.S.O., promoted Colonel, 17/8/21, with seniority, 1/5/21.
Fergusson, Lt.-Col. A. C., C.M.G., D.S.O., Promoted Colonel 17/8/21, with seniority, 1/1/20.
Joyce, Major L. W., Temp. Lieut.-Col. T.F. 25/7/21.
Kelly, Lt.-Col. C. R., C.M.G., D.S.O., to be Colonel, 17/8/21, with seniority, 8/6/20.
Kenyon, Colonel L. R., C.B., to be Major-Genl. 17/8/21.
Lawrence, Major C. T., D.S.O., Temp. Lieut.-Col. T.F., to command 11th (H.A.C.) County of London Yeomanry, R.H.A. 4/5/21.
Lyddon, Lt.-Col. W. G., C.M.G., to be Colonel, 17/8/21, with seniority, 1/5/21.
Mackenzie, Lt.-Col. G. B., C.B., C.M.G., D.S.O., to be Colonel, 17/8/21, with seniority, 18/1/19.
Mayne, Lt.-Col. H. B., D.S.O., to be Colonel, 17/8/21, with seniority, 1/5/21.
Phipps, Lt.-Col. C. F., D.S.O., to be Colonel, 17/8/21, with seniority, 18/1/19.
Riddell, Lt.-Col. R. B., D.S.O., to be Colonel, 17/8/21, with seniority, 1/5/21.
Rumbold, Lt.-Col. W. E., C.M.G., to be Colonel, 17/8/21, with seniority, 1/5/21.
Tancred, Col. T. A., C.B., C.M.G., D.S.O., A.-D.-C., to be Maj.-Genl. 17/8/21.
Twiss, Lt.-Col. F. A., C.M.G., D.S.O., M.V.O., to be Colonel, 27/8/21, with seniority, 1/5/21.
Waring, Lt.-Col. R., to be Colonel, 17/8/21, with seniority, 28/11/19.
Wilkinson, Lt.-Col. A. C., C.M.G., D.S.O., to be Colonel, 17/8/21, with seniority, 1/5/21.
Willis, Col. E. H., C.B., C.M.G., to be Major-Genl. 17/8/21.

To Temporary Half Pay.

Davies, Col. W. P. L., C.M.G., D.S.O., from Staff—Relinquished appointment and temporary rank Col. Commandant. 1/7/21.
Godsal, Lieut. H., temp. half-pay, on account of ill health. 24/8/21.
Hunt, Major C. O. C., temp. half-pay, on account of ill health. 30/8/21.
Ironside, Maj.-Genl. Sir W. E., K.C.B., C.M.G., D.S.O., on relinquishment of appointment. 8/7/21.
Luck, Lt.-Col. B. J. M., C.M.G., D.S.O., to Half-pay list. 8/9/21.
Pratt, Lieut. G. B., to Temp. Half-pay, on account of ill health. 10/8/21.
Tyrrell, Lt-Col. J. F., C.B.E., to Half-pay list, retaining his appointment. 8/9/21.

Retirements on Retired Pay.

Aiton, Lieut. R. S., (temporary), from half-pay list, with rank of Major. 24/8/21.
Anstruther, Major R. A., D.S.O., from half-pay list. 26/8/21.
Beattie, Lieut. W. M., M.M., from half-pay list. 30/8/21.
Buchanan, Capt. A., M.C. 16/8/21.
Bushe, Lt.-Col. C. K., from half-pay list. 26/8/21.
Clarke, Lieut. M. H., from Half-pay list, on account of ill health. 14/9/21.
Cleaver, Lieut. F. P., from Half-pay list. 13/9/21.
Cunningham, Major (Bt. Lt.-Col.) H. T., D.S.O., with rank of Lt.-Col. 25/8/21.
Fife, Lt.-Col. R. B., D.S.O., from Half-pay list. 16/9/21.
Fraser, Col. L. D., C.B., C.M.G., with Hon. rank of Brig.-Genl. 24/7/21.
Gatt, Major C. A. 19/8/21.
Hamilton, Lieut. R., from half-pay list. 24/8/21.
Home, Col. R. E., C.B.E., D.S.O., from Half-pay list. 3/9/21.
Kiteley, Lieut. A., D.F.C., from half-pay list. 31/8/21.
Moss, Lieut. C. E. R., from Half-pay list, with rank of Capt. 15/9/21.
Rawson, Lieut. G. R., from Half-pay list. 13/9/21.
Sands, Lieut. W., from half-pay list. 11/8/21.
Tandy, Col. E. N., C.M.G., D.S.O., with Hon. rank of Brig.-Genl. 25/8/21.
Tovey, Lt.-Col. G. S., C.M.G., D.S.O., on account of ill health caused by wounds. 21/3/21.
Tyler, Col. J. A., C.B., C.M.G., with Hon. rank of Brig.-Genl. 20/8/21.
Young, Col. H. A., C.I.E., C.B.E., on Indian Pension, with Hon. rank of Brig.-Genl. 2/3/21.

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Retirements with a Gratuity.

Allen, Major R. F. C. 26/8/21.
Blewitt, Capt. R., D.S.O. 19/8/21.
Brown, Lieut. K. H., D.F.C., from half-pay list. 24/8/21.
Elliott, Lieut. I. 13/8/21.
Evans, Lieut. S. S., with rank of Captain. 15/9/21.
Fletcher, Lieut. F. 30/8/21.
Futcher, Lieut. C. E. 9/8/21.
Hart, Capt. S., M.C., with rank of Major. 16/8/21.
Hayward, Lieut. R. H. P. 13/8/21.
Hunter, Lieut. H. W. 9/8/21.
James, Capt. A. E., D.C.M. 30/8/21.
Keates, Lieut. A. E. 9/8/21.
Monkhouse, Lieut. G. K., M.C., from Half-pay list. 9/9/21.
Thomas, Lieut. G. 30/7/21.

Resignations.

Kay, Lieut. H. G. A. 9/9/21.
Lees, Lieut. G. M., M.C., D.F.C., with rank of Capt. 20/8/21.
Moreton, Lieut. R. J. 9/9/21.
Nunn, Lieut. R. L. H., with rank of Major. 13/9/21.
Raynor, Lieut. E. W. 24/8/21.
Stanley, Lieut. R. C. S. 19/7/21.

Deaths.

Elton, Brig.-Genl. F. A. G. Y., (retired pay) at Horsham. 2/8/21.
Johnson, Major C. E. L. 18/3/21.
Kilpatrick, Capt. Qr.-Mr. C. (retired pay). 19/7/21.
Malcomson, Lieut. K. G., R.G.A., Died at Hove. 30/8/21.
Ridout, Capt. E. C., Reserve of Officers, R.F.A. 31/7/21.

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Mentioned in Despatches by G.O.C., in C. Mesopotamian Expeditionary Force, dated 7th February, 1921 London Gazette dated 9th September, 1921.

Bateman, Lieut. J. S., M.M.
Davies, Col. W. P. L., C.M.G., D.S.O.
Grehan, Lieut. S. A. J., M.C.
Sherbrooke, Lt.-Col. N. H. C., D.S.O.
Wilson, Major D. C., D.S.O.

R.H.A.

Patrick, Lieut. J., M.C.

R.F.A.

Chaytor, Major F. C., M.C.
Furnivall, Lt.-Col. W., D.S.O.
Hall, Major E. C., D.S.O.
McGowan, Major T., D.S.O.
Russell, Major H., M.C.
Smith, Lt.-Col. H. B., D.S.O.
Townsend, Major M. D., D.S.O.
Ward, Major B. S.
Welsh, Major W. M. M. O'D., D.S.O., M.C.

R.G.A.

Babbage, Lieut. P. L., M.C.
Chadwick, Major E. W., M.C.
Greene, Major (Bt. Lt.-Col.) A. C. R.
Gunter, Major A. C., D.S.O.
Knight, Major J. H.
Peart, Lieut. J. C. B.
Trenchard, Major G. B. B.

Awards, dated as above.

O.B.E.

Chaytor, Major F. C., M.C.
Grehan, Lieut. S. A. J., M.C.

M.B.E.

Crowdy, Lieut. E. F.
Fletcher, Lieut. F., (retired).

D.S.O.

Knight, Major J. H.

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R.A. Games' Fund	Lt.-Col. C. R. Gillett, D.S.O., R.A. (hon.) ...	R.A. Institution, Woolwich, S.E.18.
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R.A. Luncheon Club...	Col. C. N. Simpson, D.S.O., late R.A. (hon.) ...	1, St. James's Place, S.W.1.
R.A. Steeplechases	Col. H. L. Powell, D.S.O., late R.A.	Valetta, Emsworth, Hants.
R.A. Dinner Club	A.A.G., R.A.	Room 123, War Office, S.W.1.
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R.A. Polo Pony Club.	Capt. F. Barry, R.H.A. (hon.)	R.A. Mess, Woolwich.
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R.A. War Commemoration Fund*... ...	Brig.-Gen. F. T. Ravenhill, C.M.G., late R.A....	Artillery House, Knaresborough Place, Earls Court, S.W. 5. (Phone :—Western 4088.)
R.H.A. Old Comrades Association ...	Capt. J. Thurlow. late R.A. (hon.)	16, De Quicey Road, N. 17.
R.F.A. Old Comrades Association ...	Capt. C. J. Taylor, late R.F.A., (hon.)	3. Fenchurch Street, E.C. 3.
St. George's Garrison Church, Woolwich, Memorials Committee	Lt.-Col. C. B. Findlay, M.C., R.H.A.	R.A. Mess, Woolwich, S.E.18
"Ubique" Lodge, No. 1789	Lt.-Col. R. M. Laird, late R.A. (hon.)	c/o R.A. Institution, Woolwich.

*To benefit all ranks of the Regiment, Regular, Territorial, Special Reserve and temporary, their families and dependents, and to erect a permanent Memorial.

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"DUNCAN" ESSAY. 1920-21.

"In view of the improvements in Mechanical Transport that are likely in the near future; discuss the possibilities of its use for all natures of Mobile Field Artillery (including Horse Artillery) in substitution for Horse Draught, both on the road and across country."

(Recommended for Publication).

EXPERIENTIA DOCET.

BY CAPTAIN O. G. BODY, D.S.O., R.F.A.

CORRECT conclusions on the subject under review are largely dependent on a correct forecast as to the exact nature of future land battles. This is very hard to determine at the present time. The great war of 1914-1918 concluded just as so many new arms and weapons were in the experimental stage, that definite deductions could not be made as to their actual effect on Strategy and Tactics. There was a period when many believed that the whole art of war had been revolutionized by mechanical devices, and that entirely new principles would have to be evolved. Recently more moderate views have been everywhere evident. It is still difficult, however, to conceive how the various new arms and weapons are to be blended on the battlefields of the future, and a correct sense of proportion is hard to preserve. We must be on our guard against the great tendency of studying war simply as a matter of armament, and of exaggerating the importance of mere mechanical devices. At the same time we must study with an open and unbiassed mind the aspects of war presented to us by the highly technical experts.

It must be admitted however that the advent of the tank and aeroplane has given undue prominence to the "scientific arms", and imagination is apt to run riot in fantastic pictures of future land battles. The rôle of the Tank and Aeroplane have been so enlarged upon and magnified, that the main principles of war have been forgotten. A certain section of our military writers and critics seem to draw their inspiration from H. G. Wells and Jules Vernes, rather than from the approved and established maxims of the worlds successful commanders.

The main principles of war can never change, because they are based upon human nature—The will to conquer—Moral force—must

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triumph over mechanical advantage. War from its origin has been essentially a trial of national manhood. It cannot be won in the workshop. Decision on the battlefield must be gained ultimately by hand to hand conflict. By this means alone can it leave the victors with the feeling of moral superiority, and the vanquished moral subjugation. The infantry then is still the primary arm, and to the needs of this arm all other arms must conform.

The artillery, the tank, the aeroplane, and every other nature of arm and armament are maintained in the field with one object alone—to permit the infantry to close with the enemy—or in other words to permit the primary arm to use their primary weapon. This point is of great importance. If we still accept it as the true basis of all military co-operation on the battlefield, many fantastic ideas as to the conduct of future wars will be dispelled, and the correct importance will be attached to the capabilities and limitations of modern warfare devices.

Mechanically propelled vehicles will of course play a tremendous part in conveying armies to the actual battlefield, but there can be no likelihood at present of those vehicles accompanying any but a few specially trained men into action. The main issue must still be fought by Infantry deployed and fighting on foot.

Fast travelling tanks may encroach upon the rôle of the cavalry. Guns mounted on tanks may displace horse drawn artillery, but the tank cannot encroach upon the rôle of the Infantry. The Infantry will remain the slowest moving arm, and, when once battle has been engaged upon, still move at much the same rate as heretofore. The pace of an army is the pace of its slowest arm. So much has been written as to the speed at which future battles will be fought, that this point must be borne in mind when considering all questions which effect mobility.

When contact has been gained, and definite resistance encountered, the speed at which operations take place will certainly not be increased. Modern invention has indeed tended to make armies less mobile, by making them more dependent on their bases and workshops.

The requirements then of our mobile Field Artillery remain much the same as heretofore as regards mobility—namely: to be able to keep pace with the Infantry both on the march and on the battlefield.

The Permanent Defects of M.T.

The Title of this essay directs that the replacement of horse drawn Artillery by Mechanical transport shall be discussed "in view of the improvements in Mechanical Transport that are likely in the near future." This almost suggests that replacement is merely a matter of improved Mechanical design. It must be remembered, however, that Mechanical Transport suffers from permanent defects, which it would seem, neither time nor science can remedy. These permanent defects seem to be the real obstacle to its introduction, and for the present will limit its adoption. A consideration of them will eliminate many false conclusions as to the comparative advantages and disadvantages of the two natures of Transport.

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1. *Extravagance of personnel.*

Success in war very largely depends on economy of personnel, and the allotment of the correct proportion to the various arms and services. Mechanical devices of all kinds involve a tremendous cost of upkeep in personnel, the greater proportion of which is absolutely non-effective. It is also a great encumbrance to the bases and Lines of Communication.

Horse drawn transport is far more economical in this respect. The Veterinary and Remount services which maintain it in the field do not absorb nearly as many men, and the training is altogether an easier matter.

In France it took five men behind the line to maintain one effective bayonet in the trenches, and it is impossible to say how many more in England, exempt because they were skilled mechanics. The mass of a nation's manhood should be on the battlefield, and not in the workshops and repair depôts.

If Mechanical Transport were used in areas nearer the front, where our field guns usually operate, the personnel employed in repair and upkeep would be considerably greater, owing to the greater likelihood of damage from shell fire, and worse ground to operate over.

In England during the war there were periodical outcries against the large numbers of exempted men—A necessary evil of mechanical warfare—Even when these men eventually joined the colours, it was, for the most part, to continue their trade merely dressed in khaki. They had neither the spirit nor inclination of soldiers. Thousands of men were required on the Lines of Communication to attend to the necessary requirements of the mechanical devices with which the war was being waged. This enormous army of skilled and highly paid labour had a bad effect on the fighting troops. The influence of the workshop is invariably bad. A large proportion of non-effectives, although nominally soldiers and dressed in uniform, mixed or in contact with fighting troops, is a grave danger in wartime. It is through this element that discontent is introduced and morale broken.

Even if sufficient trained personnel were available for the maintenance of still further quantities of M.T. in the field, this permanent defect remains. It makes for a less economic distribution of personnel than horse transport. The enormous and increasing army of non-effectives is one of the great evils of modern war. The introduction of M.T. has aggravated it to an alarming extent. The time has arrived when every effort should be made to reduce this army of non-effectives instead of increasing it.

2. *Dependence on its Base.*

The mobility of Armies does not solely depend on the power and speed of the transport. The fuel from which the motive force is drawn, must be at hand to propel it. This fuel takes different forms with different natures of transport.

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For instance :—

With human or carrier transport	— rations.
With horse transport	— forage.
With mechanical transport	— petrol.
With railway transport	— coal.

The first essential for all transport in moving warfare is that it should be capable, at least temporarily, of living on the country, and that the probable local resources should be able to provide the necessary motive power. Transport itself dependent on transport for its motive power is a bad condition. All armies working under such conditions will have a limited range of operations. Mechanical transport must always have a fixed radius at which it can operate away from railhead, in just the same way that a destroyer has a fixed cruising radius. The further it is away from its base the less efficient it becomes.

Horse drawn transport has a similar and more restricted radius at which it can operate away from railhead if fed entirely by the Lines of Communication as in trench or siege operations. But in moving warfare, horses like humans can live on the country until new or shorter lines are opened through to them. Forage is obtainable locally in almost every country—not so petrol.

When operations have become stagnant, and immediate local forage supplies have become reduced, horse transport becomes even a greater strain on the Lines of Communication in forwarding supplies than mechanical transport. In moving warfare horse transport has a distinct advantage.

The advance through Belgium in the Autumn of 1918 demonstrated this point clearly. At the close the lorry transport was in difficulties in maintaining supplies at any great distance from railhead, in spite of the many roads behind it. The further the advance continued, the more our horse drawn transport could depend on local supplies and requisition, while each day the M.T. was less efficient. It is impossible to think how the many requirements of mechanically propelled transport could have been met, had our field guns for instance, been drawn by tanks instead of horses.

Our artillery at the commencement of the war was transported from Mons to the Marne by horse transport almost entirely living on the country. Mechanical transport throughout such a march would surely have been in greater difficulties.

The above considerations, then, lead us to assume that the horse has advantages as a means of transport for all guns primarily intended for moving operations, and mechanical transport for all guns primarily intended for trench and siege operations.

For supplies mobile armies have largely been dependent on requisition. Armies equiped with M.T. will have their mobility seriously impaired by having no chance of drawing their motive power from local resources.

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The disadvantages of mechanical transport already noted, necessarily entail another serious defect. Our Commanders are tied more and more to their lines of communication, and variety of action becomes almost impossible. Great variety of strategy, such as change of front, base, or direction of march, etc., and all similar operations of war, become increasingly difficult. Strategic frontal attacks alone seem possible. Heavy and ponderous methods of war take the place of the subtle strategems which have marked the victorious campaigns of history down to the opening of this century.

3. *Repair, Overhaul, etc.*

Mobile artillery transport must be capable of continuous effort. It is of more importance to be able to continue day after day than to make one effort at high speed. Pressure on an enemy must be relentlessly and increasingly applied. The horse is capable of such effort; whereas the Tank fitted with a powerful and complicated engine, must be withdrawn from the line for overhaul after approximately twenty-four hours continuous running. The Tank most certainly cannot be maintained in movement day after day. So long as infantry remain the arm which the artillery are called upon to serve, greater speed is not of great necessity. Batteries have marched fifty miles a day frequently. This gives an ample reserve of mobility.

The horse too has a wonderful reserve of power and can work on half or reduced rations, and on several different natures of forage; whereas the Tank is capable of a fixed effort only—so many miles to the gallon.

The horse again is adaptable to all climates. Winter campaigns in such countries as Canada, Russia or Siberia would be impossible with tank drawn artillery.

The advantages of a six-horse gun team are many. Again there is a reserve of power. In the event of casualties it can work with four horses, or outriders can be hooked in. In fact in the whole of history in moving warfare, it is difficult to find a single instance in which the guns failed to arrive.

4. *Expense of Tank Type M.T.*

Mechanical Transport can be divided into two distinct types :—

1. The Lorry type.
2. The Tank type.

We must look upon the former as the second line transport of mechanical warfare. It is capable of operating over good roads only, and has replaced the heavy draught horse almost entirely.

The latter is the first line transport of mechanical warfare. It is capable of operating over all natures of country in face of an enemy. It is alternative transport to the light draught horse.

In this essay it is assumed without further argument or comment that the tank type can alone be considered as possible artillery transport for field guns.

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There is one essential difference between these two types. Local peace time resources can supply the former—not so the tank. The tank like the battleship will be a direct burden on the national exchequer. The large numbers required for the complete equipment of our army cannot possibly be forthcoming while the present demand for economy lasts. In fact it is doubtful if they can ever be maintained in sufficient quantities to render them the primary means of first line transport. The question of forming a reserve both of vehicles and trained personnel is almost impossible as the tank can never have a commercial value.

The great question of supplying M.T. in place of horse transport does not affect the artillery alone. All arms are affected. Where is this new demand for M.T. to stop? Will the day soon come when Infantry supplies, rations, ammunition, R.E. stores, etc., all go forward in tanks? The question of maintaining enormous fleets of tanks would involve terrific expense and leads us to suppose, that at least the transformation can only be a gradual one, and certainly limited as to the arms it affects.

GAS WARFARE.

We must consider all points which affect the whole policy of Tank transport and armament generally, before passing on to the particular developments which may be expected in our own arm. Gas warfare has a considerable bearing on the subject under review. Many proclaimed it as the beginning of the end of civilized war. War, they said, was becoming so deadly, that neither man nor horse could face it. The introduction of the gas proofed tank (although experiments of a satisfactory nature have not yet been completed) seems to present a great solution. Tank enthusiasts invariably bring it forward in argument to emphasize opinions in favour of tank armament and transport.

We must endeavour, however, to fix in our mind, the way in which gas warfare has affected the future battlefield.

Gas had its origin in trench warfare, and is primarily for use in siege and trench operations. If thrown by artillery, large concentrations of guns are necessary, and large quantities of ammunition, in order to render a gas bombardment effective. If such bombardment is used as a preliminary to attack, the ground will be equally deadly to our own men. Gas does not adapt itself to attack. It is a defensive or neutralizing agent.

There are many who predict, that in moving war large armies of tanks, fitted with gas proofed devices, will advance liberating gas and destroying all before them. To liberate gas in sufficiently dense clouds during trench warfare is a difficulty. In more open operations effective gas attacks will be well nigh impossible, even if wind and atmosphere are favourable. In such operations ground may be of little importance. If a locality is saturated with gas, it must merely be looked upon as a temporary obstacle, impassable to both sides alike, unless provided with effective masks or proofed vehicles. The liberation of gas by an attacking enemy would be a grave tactical

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mistake, so long as Infantry were the arm with which the ground had to be occupied. A correct tactical use of gas, for instance, would be to liberate it after unsuccessful attack, in order to break off a fight and avoid counter attack, or to gas villages during retreat, and such like operations. For offensive operations in moving warfare it has little tactical value.

Troops have never been so concentrated perhaps in any sphere of operations, as they were in the Ypres Salient from July to November, 1917. Certainly such a concentration of field guns has never before or since been effected. Gas was liberated in every form by both sides—shell, bomb, projector—until the ground was saturated, and still horses continued to bring ammunition forward night after night by pack. The conditions for gas warfare were the most favourable possible. The gas was being used for the particular purpose of harrassing supplies of food and ammunition, but the horses worked through it all, with comparatively few gas casualties.

Gas can never be so deadly in moving warfare. Its importance has been greatly exaggerated owing to the casualties it has inflicted in battles of attrition. When decision is sought, it must be sought with the bayonet. The artillery must prepare the ground for the Infantry to operate over, not with gas, but with shell fire.

The substitution of M.T. for the horse in existing batteries would still leave the personnel as vulnerable as ever. Armed gas proofed batteries could never be evolved from existing artillery batteries. Tanks would have to be specially designed and armed.

* * * * * *

Were it not for the permanent disadvantages of Mechanical transport already set down, and the present great need for economy, there can be little doubt that horse drawn artillery would soon disappear. Mechanical devices have already been invented which can accomplish all that is performed by a six or eight horse gun team, and we can look to the future with confidence for still further improvement in mechanical design. In some instances even tank transport has succeeded in taking guns forward where horse draught has failed. No one can doubt that tank artillery transport has come to stay, although there is doubt as to exactly in what form and to what extent.

Before considering the tank merely as a means of transport for existing weapons, we must consider how the tank as an arm has affected the whole employment of artillery in war. The tank, as it was developed in the last war, i.e. as an entirely new arm, has encroached upon the normal artillery rôle. It has reduced the necessity of intense bombardment and is capable of relieving the artillery of many of its old responsibilities. It has revived shock action. Indeed the necessity of an arm which could employ shock tactics against modern weapons was the mother of its invention.

Tank warfare too has opened up a feature of attack against which opposing artillery seems powerless. The counter to the tank is undoubtedly the tank.

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Infantry are calling for closer and more intense supporting fire. Five years ago the only reply to such a demand would have been more guns. To-day there is an alternative—more tanks. Most of us will reluctantly admit that this is the correct reply. The establishment of the tank corps has seriously challenged our own arm in the rôle of effective infantry support.

There are two particular phases of war which are calling out for the immediate development of tank armament.

1. The opening stages of a campaign in gaining contact with an enemy, i.e. fast tank and armoured car operations previously the work of the Independent Cavalry.

Horse artillery whose primary rôle is cavalry support will not be able to keep pace with such operations. There will undoubtedly be a demand for light field guns mounted on light tanks to accompany the fleet of mechanically propelled vehicles which we may expect to advance in front of modern armies. This kind of armament will also play the normal cavalry rôle in pursuit and retreat.

2. In breaking down resistance in strongly fortified areas, i.e. the normal heavy tank operations of the last war.

The passage from the defensive to the offensive still remains one of the most difficult operations of war. Our commanders are bound to be confronted again and again with the difficulty of breaking dense lines of fortifications and changing to moving warfare in the country that lies behind them. To this particular kind of operation the tank is admirably adapted.

Wars of the future are bound to alternate between extremes of trench and moving operations. Curiously enough it is the two extremes of warfare which are calling for the immediate development of an efficient Tank Corps.

Prior to the last war our field guns provided, as it were, the first echelon of supporting fire that maintained our Infantry in forward movement. During the war certain armament was developed to supply a more advanced echelon. The machine gun and the Stokes Mortar for instance—and finally the Tank, carrying machine guns and light field guns.

The conditions of modern war have rendered it necessary that we employ closer supporting weapons. Infantry must be accompanied, especially in trench operations, by weapons that can move forward quickly, and place their fire according to the deductions of immediate observation and so clear up all local and unforeseen situations. In France the Tank succeeded in this rôle admirably where in similar instances the field batteries had failed.

Their ability to advance and give this support had been due to the following reasons :—

1. Their all round bullet proof armament.
2. Their ability to overcame normal obstacles such as wire, trenches, etc.

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3. Their ability to fire during movement thus gaining comparative immunity from enemy artillery fire.

Of the above considerations the latter is perhaps of the greatest importance.

Ability to advance in close support of Infantry and fire direct on immediate targets is the chief characteristic of Tank warfare which has proved so valuable.

It is the primary requirement of all Tank armament. The combination of Tank and gun finally evolved must be capable of fulfilling this rôle.

Mobile Garrison Artillery.

The Mobile Garrison Artillery prior to the last war was drawn by heavy draught horses. This form of transport it would seem is doomed to disappear. During the war transport of the lorry type was developed and replaced the heavy draught horse to a very large extent. The advantage of the lorry type of transport over the tank type from an economical point of view has already been noted. Its success is dependent on a good road system. Our heavier mobile pieces are certainly intended for the more deliberate operations of war, and good roads may be the normal conditions to expect during such operations. All transport however should be capable of pulling its guns direct into action without the enormous amount of man handling which lorry type of transport usually entails.

Transport of the tractor or tank type would certainly have advantages. With the heavier mobile pieces, there can never be any alternative, it would seem, but to have the gun limbered to its transport. In which case fair conditions of ground or road will always be essential before any type of mechanically propelled heavy artillery can operate freely.

With R.G.A. Batteries various types of M.T. can be looked upon merely as alternative transport and few difficulties arise. The transport itself is not going to alter the tactical use of the armament as is the case with the lighter field guns. M.T. of all types has advantages in trench and siege operations. R.G.A. armament primarily intended for such warfare is well served by it.

Royal Field Artillery.

If the tank is to be used in substitution for the horse in the field artillery it would seem that there are only two courses open.

1. The Tank limbered to the gun.
2. The gun carried on board the tank and unshipped for action.

In both these we find that the all round bullet proof armament of the tank is not made use of to cover the detachment. The gun also cannot be fired during movement. The ability of the tank to overcome normal obstacles is alone utilized.

The gun of course could be a fixture to the tank but this would involve entirely new mountings and sights. Only the piece could be

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used, and a great deal more than merely the substitution of the tank for the horse would be involved.

The ideal combination of tank and gun would be one in which the gun could either be fired on board the tank during movement or temporary halts, and also be unshipped for action when occupying more permanent positions. The disadvantage of leaving a complicated machine like the tank permanently in action and exposed to enemy fire is obvious to all and needs no comment.

The actual tank must be capable of being withdrawn to a safe position in rear, where cleaning repairs and overhaul can be conducted, without taking the guns from the line. Such would seem to be the ideal combination of gun and tank.

A Battery in which the tank had been merely substituted for the horse, would still be unable to give that close and immediate support for which the Infantry are calling, and would in no way be capable of fulfilling the primary rôle for which the tank was intended.

For our present equipment Mechanical transport could merely provide increased speed of transit from one portion of the front to the other. It could also in certain cases facilitate passage over difficult ground. The quick transit from one portion of the front to another could well be accomplished by limbering a field gun to a lorry. The detachment, ammunition, etc. travelling in the lorry. The passage forward over difficult ground could be performed by tank transport,—again the gun limbered to the tank. If there was occasion for either of the above, there is no need why an M.T. or Tank Company should not be called upon to move a field battery.

There must be no confusion between the advantages of the tank as an arm and the tank as a means of transport. The tank as an arm, equipped with light field guns, has a great future before it. It may be that in time, it will largely replace the horse drawn batteries. As a means of transport for existing weapons, however, although its advantages may more than balance its defects, the expense and upheaval entailed would not warrant its introduction.

Royal Horse Artillery.

We have already stated that we must look upon the armoured car and light tank as largely usurping the rôle of the cavalry and R.H.A. in future wars, and we may expect an immediate development of light tank armament for the purpose.

M.T. in substitution for the horse in the R.H.A. would be but a poor makeshift in comparison to a properly designed tank battery. The combination of gun and mechanical transport designed for this new rôle should most certainly have the weapon fixed and must be capable of being fired when in motion.

The device which is to propel the mechanical R.H.A. of the future must act as something more than transport. It must confer upon it all the characteristic features of tank warfare, particularly that of shock action. It must be capable of taking its guns right in to the front of the fight.

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We must always remember, however, that the Cavalry is the mother arm of the Horse Artillery. Changes in the former will be the true indication that the time is ripe for changes in the latter. If the Cavalry are gradually superseded by a faster travelling mechanical arm, artillery must immediately be produced than can keep pace and co-operate.

In looking upon the Tank as a possible means of transport for existing field batteries, are we not taking a confused and restricted view of the matter? Should we not rather give our designers a free hand to evolve a tank and armament to combine the greatest efficiency and meet the requirements for which special demands are being made? If it is agreed that tank batteries are of the greatest use in war, do not let us have any half measures of compromise and makeshift.

The tank itself is an engine of war just as an aeroplane or battleship is. Merely as a means of transport it is wasted. In the Cavalry the horse is not looked upon as a means of transport. The horse provides the essential characteristics of the arm. So in the combination of gun and tank which is eventually evolved, it is the tank, and not the weapons it mounts, which is going to provide a new feature in war and cope with the new difficulties which have arisen.

The combination of existing guns with tank transport can never embrace all the particular features, which a specially designed tank battery could do. The tank must be put to its best advantage. Attempts to make use of existing armament, or to convert an existing arm into something so totally different, may in the end be far from economical.

Tanks mounting light field guns are already in existence. Tank artillery has already started its development. The real point at issue is—whether to develop the combination of field gun and tank as an entirely separate arm—or to patch up, and convert, an existing arm to meet as many of the new requirements as best it may.

The horse has permanent advantages as a means of transport, which one is apt to overlook. For the immediate future—for the present generation at all events—we must look upon the horse as the primary means of mobile artillery transport. While there are no material changes in the methods by which the Infantry are committed to action, horse drawn field Artillery can effectively fulfil its rôle of co-operation and support in mobile warfare.

Tanks mounting light field guns however must be maintained in the service at all costs, but it would seem that for some time to come they must be looked upon as a separate arm. A horse drawn battery is not a unit that can be converted into an effective Tank battery.

Tank batteries must gradually evolve themselves. As they develop and if they prove their efficiency, and meet the varying conditions of war with success, then may the horse drawn batteries be disbanded and broken up.

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ARTILLERY EXPERIENCES OF THE CAMPAIGN IN ITALY.

October, 1917, to November, 1918.

BY CAPTAIN L. F. GARRATT, D.S.O., M.C., R.A.

BEFORE proceeding to a general description of the Campaign on the Italian front let us first consider the reasons leading up to the enemy's decision for an offensive on the Italian front in 1917, the general position of the opposing Forces there at that time and the enemy's plan of campaign.

At the end of 1916 the High Command of the Quadruple Entente (through the mouths of Hindenburg and Ludendorff) had decided against taking the offensive on the Italian front on the grounds that Italy was so much under the heel of England economically and therefore politically that it would be impossible, even if they inflicted a crushing defeat on Italy, to force her to leave the Entente ring and so to make a separate peace. What had now made German Main Headquarters change their mind? the reason is not far to seek. The Austro-Hungarian armies had never really recovered from their defeats on the Russian Front and with the death of the aged Emperor Francis Joseph the Austro-Hungarian races fell still further apart internally; in spite of the Russian revolution the Russian colossus had not yet finally fallen. In August 1917 General Cadorna had initiated the eleventh Isonzo battle and the Austrians had not fared well; any further retreat would mean the surrender of Trieste to the Italians and Trieste was the great bone of contention, the Port Arthur of the Adriatic, the surrender of which would have a far-reaching effect on the people of Austria-Hungary. In short the Austrian High Command considered that the Austro-Hungarian army could not in its present state survive another Winter Campaign but stated that a successful offensive in Italy would do much towards reviving the morale of the army and the nation. German Main Headquarters therefore decided on an offensive for politically defensive reasons that is to say in order to keep Austria-Hungary in their own ring, and not to squeeze Italy out of the Entente ring. The idea of an offensive on the Italian front had always been welcome to the Austrian High Command although they were, owing to their commitments on the Russian front, where they never fought with an heart, too weak to undertake it without the assistance of German troops.

Thus was the decision made. What would now be the soundest strategical plan of attack? A glance at a map of Northern Italy will solve this question. In no other theatre of war at that time did the

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opposing lines offer such a splendid strategic contour as that offered to an Austrian attack from the Southern Tyrol down the passes leading to Peschiera—Verona—Bassano thence south-east towards Venice taking in rear all the Italian armies operating on the Carso front more than a hundred miles further East. Why then did not the Germans adopt this plan? At the end of 1916 General Conrad had stated that he could not again undertake a big offensive from the Tyrol unless he had strong German support, a matter of some twelve German divisions; since then the Austrian position had not improved. At the end of 1917 Germany, harassed by our violent attacks in Flanders could not spare more than half the number of divisions requisite for an offensive from the Tyrol even on the assumption that such an offensive would probably mean the diversion of British and French divisions from the Western front, as owing to the numerical superiority of the allies the diversion of these divisions would not be felt as much by them as the diversion of an equivalent number of divisions would be felt by Germany. There was also the possibility that an early winter might descend on the Tyrol before the concentration was complete. Germany was therefore obliged to cut her coat according to her cloth and had to fall back on the second best plan, which was to break through the weak Italian Northern Army at Tolmino and appear on the flank and in rear of the Italian armies to the South before they could cross the defences of the Tagliamento. We will now see what actually happened.

On the 24th October 1917 the Austro-German forces attacked at Tolmino, the preparation for the attack having been carried out more by means of propaganda than by more violent weapons. The attack was entirely successful and the whole Italian northern army gave way; to the north-west impregnable mountain positions were surrendered to the enemy without a shot having been fired; the armies to the south were in a most perilous position; the Carso and the Tagliamento positions were in turn abandoned; several hundred thousand prisoners, many guns and much war material fell into the hands of the enemy. The Italian retreat bordered on a rout and it was only with difficulty that they were rallied on the line of the Piave 70 miles further west. To a resolute enemy retiring according to plan successive lines of rivers in rear and at right angles to his lines of retreat are a source of great strength, each one representing to him fresh chances of defence and the ultimate decisive counter attack. To a demoralised enemy such rivers are only a source of danger as representing fresh lines against which they may be cornered and enveloped; by such means were the majority of Italian prisoners taken.

To this debâcle was given the name of Caporetto, yet in spite of all that was said in allied countries at the time we must remember that the Italian soldiers had many hardships to bear including the immense demands of mountain warfare in the regions of perpetual snow; very few reliefs of units took place, rations were very poor and insufficient and the Italian soldier had never been informed why he was at war or what issues were at stake. He seldom saw a newspaper and lived on rumours; his officers never enlightened him; was it then so wonderful

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that he quickly grew war weary and adopted the line of least resistance? Is it not indeed marvellous that a retreat of such soldiers was ever stayed, and that before a single French or English soldier ever reached their front line? To this we must always add one debt of gratitude to Italy that by her sincere declaration of friendship in August 1914 France was able to withdraw her last man from the Franco-Italian frontier and hurl them against the advancing Germans and in those dark days what issues may not have hung on the extra men so relieved.

At the commencement of the German attack on Tolmino there were no British troops in Italy, except a few six-inch howitzer batteries and one 9·2-inch howitzer on the Carso front. These were tactically under the command of the Italian Artillery Commanders. These batteries lost no guns during the retreat but most of the men lost all their kit and the batteries were eventually withdrawn to Ferrara near Venice having had a pretty hard time during the early part of the retreat. Shortly after the Caporetto affair there was a change in the Italian High Command and General Diaz became Generallissimo on the Italian front.

To steady the Italian front British and French reinforcements were despatched from the Western front early in November. The French reinforcements took precedence over the British and were therefore allotted the shortest route via Modane—Cenis Tunnel—Turin—Milan.

To the British reinforcements was allotted the longer route via the Rhône valley and the Franco-Italian riviera. The journey from Godaersvelde in Belgium to Isola della Scala where the writer's battery detrained took six days. The British reinforcements consisted of Second Army Headquarters, Headquarters XI and XIV Army Corps with Corps Heavy Artillery and five divisions and an R.F.C. wing. The British batteries at Ferrara also came under the British command. The General Staffs of some of the British formations had been sent on ahead to find out how the land lay and as a precautionary measure a reconnaissance of the line of the Mincio had to be carried out. The heavy and siege batteries came all the way from France by train but some of the Field batteries marched through the French Riviera portion of the route. Some of the mechanical transport columns did the whole journey by road taking some fourteen days. The writer's battery detrained on 21st November.

Then followed a period of concentration, reconnaissance and deployment. At first there was some talk of the British Forces being sent into the Mountain area in the neighbourhood of the Asiago plateau but as they were in no way equipped for a winter campaign in the mountains it was decided that they should take over the Montello sector of the Piave line. The Montello was therefore reconnoitred at the end of November with a view to finding battery positions and the Heavy Artillery was concentrated in the Montebelluna area immediately in rear of the Montello. From there it was brought into action during the first week in December as soon as the positions were ready.

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The Montello itself is a long ridge about 7 miles in length and 2½ miles in breadth and of an average height of 800 feet, the highest point near the centre of the ridge being about 1,200 feet; the ridge runs approximately due east and west. Coming down from the mountains from the north the river Piave flows first south-west then leaving the mountains bends round towards the south and south-east till it meets the Montello, along the northern edge of which it flows in an easterly direction. The river then leads sharply round the eastern end of the Montello and flows south-east towards the Adriatic which it enters about 15 miles north-east of Venice. The Montello position overlooked the enemy position everywhere except on the east where it was itself overlooked by the heights round Daniele from which it was separated by the river Piave. It was at first intended to recapture the Daniele heights but all chance of doing this was lost as the Italians abandoned the Nervesa bridgehead and blew up the two bridges before the English took over the line, thus abandoning their last link with the eastern bank of the Piave. The Austrians were also coming up now in greater numbers and their Artillery was coming into action. Any attempt to capture the Daniele heights would therefore involve a major operation and considerable artillery preparation. This at the moment we were not in a position to carry out.

Roads on the Montello were numerous, there being in all twenty-one roads crossing it from north to south. South of the Montello there were two roads running east and west, the most southerly one being the main Montebelluna-Nervesa Road. There was also a Military road running along our side of the crest but this did not extend as far as the eastern end of the Montello. These three roads formed the means of lateral communication. The surface of all the Montello roads was soft and almost impassible for heavy traffic after frost or in wet weather and the gradients were steep. The Montello is of volcanic origin and has a large number of hollows which offered excellent howitzer positions. The positions of the heavy artillery were nearly all on the southern side of the crest but the Field Artillery had to go forward to the enemy's side of the crest but generally found good positions in hollows. The area was also tolerably well wooded. Although the whole of the enemy country to the north was overlooked by our O.Ps. the enemy himself was much favoured by the growth of vines which were an excellent natural camouflage to conceal his works and movements. The enemy also employed artificial camouflage to conceal movement on his principal roads whenever these were visible to us.

On the 11th December the enemy delivered a very strong attack on the Monte Grappa position away to our left and on the Brenta Valley positions; at the same time he made an artillery demonstration on the Piave front and made an unsuccessful attempt to cross the river in one or two places.

After 11th December the enemy confined himself to violent attacks in the mountains on our left in a final effort to reach the plains on our

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flank and rear. These efforts he finally had to break off about the 20th December owing to the advent of the winter snows.

What good then had this offensive brought to the Quadruple Entente? that their advance had succeeded their original expectations there was no doubt, and their failure to press the pursuit beyond the Tagliamento may be largely attributed to this, as they had made no adequate transport arrangements for an immediate advance beyond this line.

The enemy did not therefore arrive in strength on the Piave much before the third week in November. By this victory, however, the morale of the army and of people of Austria-Hungary was sufficiently revived to enable them effectively to hold the Italian front, and for the moment the danger of Austria-Hungary opening negotiations with the Allies for a separate peace was avoided; it had revived the war spirit.

Moreover the Austro-Hungarian army could in future hold the Italian front alone, without Germany's help so that Germany began shortly after the New Year to withdraw all her units and send them to France for the Great Offensive which she was preparing to launch against the Allies.

One of the first tasks of the British on the Montello front was to obtain a moral superiority over the enemy. In this they were ably assisted by the French troops on their left who held as far as the Monte Grappa position. This moral superiority was obtained by—

(i). Vigorous infantry patrols pushed across the Piave at night and later by raids across the Piave. This was difficult; attempts to cross by boat were not successful as the current was very strong; wading was also difficult as fords had to be found and the water was ice cold. The latter however was the method chiefly used, the men being "roped" to each other in parties on the same principle as in mountaineering. In many cases prisoners were successfully brought in. The bed of the Piave varied from a couple of hundred yards in width opposite the eastern end of the Montello up to eight hundred yards on the north side. The water however at this time of year did not nearly cover the whole breadth of the river bed, which could be well defended by machine gun fire. On the east this was almost the only means as owing to the steepness of the cliffs and the narrowness of the river only a few specially sited howitzer batteries could drop shells into the river bed.

(ii). By vigorous counter battery work and punishment of all enemy movement. In this the artillery were ably assisted by the R.A.F. who first spotted the hostile batteries and then ranged ours. Most of the hostile batteries were sited around the high ground of the Daniele ridge from which they could enfilade our positions on the eastern end of the Montello. It was also possible to carry out many counter battery shoots with ground observation as it frequently happened that some house which was clearly visible was within 50 or 100 yards of the hostile battery. Guns were then ranged on this house and afterwards switched the necessary amount to bring the guns on to the

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battery. Line was then kept by direct observation on the tops of the bursts and cross observation was occasionally employed when time and communications permitted. In any case guns were occasionally checked back on to the house again for range during the shoot. The Austrian artillery at first made no reply to our counter battery work and remained very silent. Soon, however, they adopted a more active policy and, although they did very little counter battery work and that of rather poor quality, they took to shelling villages in our lines pretty heavily at times. Up to now we had been rather tied by the Italians who would not allow us to shell Italian villages in the enemy's lines, partly because there were Italian civilians still living in many of them, and partly because they did not wish the villages to be destroyed from sentimental reasons. This difficulty however was now overcome and a vigorous policy of "village" for "village" was adopted, sufficient batteries being detailed for the "punishment shoots" to ensure the enemy receiving more than he gave. These punishments shoots were generally short but intense and their moral effect was such that the enemy's artillery activity rapidly waned.

One of the most difficult problems for the artillery on the Montello was that of supply as roads were impassable for motor lorries except in dry or frosty weather and the horse transport was insufficient for the needs of batteries. Ammunition could of course be dumped during dry and frosty weather but this did not relieve the situation as regards rations, which had to be sent up daily whatever the weather might be. There were a limited number of "aerial railways" but they were slow and their carrying capacity was small; also they frequently went out of action; had there been more of them this perhaps would not have happened, as the strain on them was at times very great. The Heavy Artillery were but little worried by hostile fire with the exception of the positions at the eastern end of the Montello which could be taken partly in enfilade; even there casualties were slight compared to the Western front. Conditions generally were a great improvement on those experienced on the Western front and many batteries had houses for their billets. The weather was severe at times but there was but little snow, and very little mud off the roads. On the plains there was much fog during November and December but the Montello escaped this being too high for low lying fog and not high enough to be shrouded in cloud.

It was important to prevent the temperature of the cartridges from falling below 40° F. and cartridge stores artificially heated with safety stoves had to be built. During the hard weather there were several cases of trails buckling. This was overcome by using brushwood under the trails. The Austrians had no connected trench system and took no steps to make any; they relied entirely on a series of posts distributed in depth and in short lengths of trench. The British during the winter dug two lines of defence on the Montello.

From Christmas onwards the enemy carried out a number of air raids on Padova, Venice, Castel Franco and other towns in rear of our

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lines. These raids were carried out almost entirely by German squadrons and ceased after their withdrawal to the Western front early in March. The Austrians showed as little enterprise in the air as they showed on the ground. These air raids caused a great outcry in the Italian press and even in our own press at home. It assisted our propaganda to make the most of raids on Venice and Padova, but if Venice was a city of treasure, it was also the foremost naval arsenal in the northern Adriatic, it was used by the Italians as a submarine base and was a direct menace to Trieste and Pola. If Padova was an open town it was also the seat of Army Headquarters. If Castel Franco contained a hospital it also contained a French Headquarters and the General Commanding the Artillery of the French Army in Italy was himself killed in a hostile air raid on that town.

Towards the end of February information was received that the British Army Headquarters, the Headquarters XI Corps and two divisions were to return to France and the remainder of the British troops were shortly to take over a new sector of the line on the Asiago Plateau. Early in March reconnaissances were made on the Plateau for battery positions. The Asiago Plateau consists of undulating grass land the average elevation of which is about 3,500 feet, the town of Asiago itself being about 3,200 feet and about the lowest point of the Plateau. The Plateau runs due east and west and is about 5 miles across, being saucer shaped and bounded on the north by mountains between 5,000 and 6,000 feet in height and further north still by even higher mountains. On the south it is bounded by a marginal chain, which is really three sub-chains each separated by a valley about a mile in breadth. These marginal chains are from 4,500 and 5,000 feet in height, the valleys between them being about 500 feet lower.

The Plateau itself is very open but the slopes of the mountains on the north and south are mostly well wooded. From the most southerly marginal chain there is a steep descent of more than 4,000 feet to the plains below. The snow on the Plateau rarely melts before the end of April and the weather in Winter is severe, as much as forty-nine degrees of frost having been recorded at Asiago and the average depth of snow in February is 6 feet. The Summer months compare favourably in warmth with those in England but the nights are generally colder and thunder-storms are frequent. The most unpleasant months are April when the snows begin to go and October and November before they finally arrive again. Military operations on the Plateau are only possible between May and the middle of November. The snow fall on the Plateau during the winter 1917—1918 was below normal and when reconnaissances were made in March there was only a depth of some 2½ to 3 feet on the last marginal chain overlooking Asiago from the south, behind which most of the Heavy Artillery positions had to be found. The chief difficulty was that of clearing the crest as the hillsides were steep and it was also desirable to select positions in which tree cutting could be reduced to a minimum.

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By combining the spare parts of charges it was found possible to make nine different charges for the six-inch howitzer and range tables were worked out and issued for these. The extra charges were found most useful for covering what would otherwise have been dead ground. These charges worked very well and gave good results. The ground beneath the snow was most uneven and gun platforms had in the first place to be sounded for with Alpenstocks; having found a reasonably level piece of ground by this means the snow had then to be cleared and the platform finally levelled off, generally with the assistance of explosives as the ground was very rocky. O.Ps. were mostly in little wooden huts built in the pine trees. On a windy day one could well imagine that one was at sea. Main roads were of course kept clear of snow; by day the surface thawed but at night even early in April it froze hard and the surface was extremely slippery. The Heavy Artillery left the Piave front towards end of March and came into action on the Asiago Plateau early in April. The long ascent (some twelve miles) from the plains to the Plateau was difficult and there were many hairpin bends. Animal draught was of course out of the question and no animals were at this time employed on the Plateau with the exception of some Italian ration mules who were shod with frost nails. Each six-inch howitzer or sixty-pounder gun was drawn up the road to the Plateau by two four-wheeled drives and each battery was allotted an Italian tractor (120 h.p.) to help it over the more difficult portions of the route. Frequent halts were necessary to allow engines to cool and the journey generally took anything from 6 to 12 hours. Once on the Plateau skid chains had to be used by all lorries and F.W.D's and over some places the Italian tractors were invaluable.

Communications on the Plateau were not numerous, there being only two roads down the hill from front to rear on the British front when they first took over although another lateral connecting road was built later. There were only two lateral roads across the front, one on the very edge of the Plateau and one further forward about the Heavy Artillery line.

The Austrians were somewhat similarly situated as regards communications. The Asiago front differed from the Montello front in that both sides possessed an organised and continuous trench system with support trenches, and several reserve lines connected by switch trenches. The British trenches were on the forward slopes of the marginal chain overlooking Asiago. The Austrian trenches were in front of Asiago on the low ground; their reserve positions and batteries were situated on the slopes of the mountains north of Asiago.

On the British front "No Man's Land" varied in breadth from 500 yards opposite Asiago to about 2,500 yards a couple of miles further west. The French divisions were on the right of the British. The Headquarters of all formations up to divisions inclusive were situated on the Plateau.

When the British took over from the Italians on the Plateau the front was a very quiet one. Our Field Batteries for the most part took over from Italian Field Batteries and their S.O.S. lines frequently

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entailed firing at an angle of depression, owing to the enemy's position on the Plateau below. Firing up or down hill made considerable difference to the elevation to be put on the gun (quite apart from the angle of sight). This was especially the case with howitzers firing at long range and frequent use had to be made of the "Maitland Addison" corrections. The normal barometer reading on the Plateau was about 26 inches thus giving a permanent normal correction of minus four inches. The Heavy Artillery had to select and build new positions for themselves. Accommodation, which was in wooden huts was insufficient but the ground was largely rock and good dug-outs could be made with the assistance of explosives and motor rock drills, but this all took time. There was also an abundance of timber for strutting and roofing. By the first week in May the snow had disappeared and the weather became warmer and more settled. The plan of the Italian High Command was to attack the Austrians if they sent any divisions to the Western front but otherwise to await the development of events. Forward gun positions were therefore reconnoitred, some even being in No Man's Land; platforms were built, ammunition was dumped and a guard kept day and night over the positions.

Meanwhile we carried out vigorous trench bombardments and counter battery work. Towards the end of May however all idea of an Allied offensive was given up and the ammunition dumped in forward positions was mostly withdrawn. The Austrians had sent no divisions to the Western front.

Orders were now issued for a mobile Army reserve to be formed on the plains, a reserve which was to be ready to move in any direction at very short notice. About one half of the Heavy Artillery was withdrawn to form a part of this reserve. About the 10th of June, however, orders were issued for the whole of this reserve to return to the Plateau between the 12th and 14th June, some of the artillery coming into action in the forward positions originally selected as attack positions. It was generally believed that we were to carry out our original attack after all and considerable harassing fire was carried out against the enemy on the nights of 13/14 and 14/15 June. Actually the Italian High Command had decided that the British should carry out their original plan of attack in a modified form in order to forestall the offensive which the Austrians were known to be preparing to launch at an early date. The expected date for the Austrian attack was not known to the British batteries in the line and it certainly was not expected for 15th June. When therefore the Austrians opened their bombardment on our front and reserve line at 3.0 a.m. on 15th June immediately following a long burst of harassing fire from our guns it was at first taken only to be a retaliation for our own fire. Soon however it became obvious that it was something more than this. Communication to forward O.P's began to go but one F.O.O. reported that he could see the flash of Austrian guns "just behind their front line"; the Austrian fire commenced to move back on to our roads and communications and the whine of high velocity shells could be heard going over towards Divisional Headquarters at Grannezza; telephone com-

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munication with Group Headquarters had gone. Fire was therefore opened on counter-preparation targets. It was unlikely that the enemy would attempt to enter our trenches till dawn, although he would be sure to try and get over the difficult and exposed positions of "No Man's Land" while it was still dark. Shortly before dawn, fire was brought down to the S.O.S. lines and an F.O.O. sent to Monte Torle only some 300 yards from the advanced section of the writer's battery; it was difficult to maintain telephone communication even for this short distance as falling trees and flying rock splinters were more deadly to the wires than the shell splinters themselves. An attempt was made to get into touch with Group Headquarters by means of runners and by cyclist D.R. The latter could however for a long time make no headway beyond Pria dell Acqua as the Pria dell Acqua—Granezza road was blocked by fallen pine trees, brought down by the barrage. Communication was with difficulty kept with one or two neighbouring batteries. The enemy also started to use gas shells; but not in sufficiently concentrated form to cause more than slight and temporary inconvenience. About 7 a.m. a message was received from a Field Artillery Brigade Headquarters close by that the enemy had entered our front line in the neighbourhood of Cesuna (on the left). There was a thick mist most of the day but fleeting targets in the shape of enemy parties in "No Man's Land" presented themselves from time to time and were successfully engaged as were also hostile batteries in the open. Hostile fire died down after 11 a.m. and a counter attack at dawn on 16th June regained for us all the ground which we had lost. The artillery lessons learnt from this attack were: (a) The value of O.Ps. close to batteries with which communication by runner could be kept. (b) The uselessness of cable communication in wooded areas unless it is buried. (c) The advisability of having a proportion of the heavy artillery echeloned well in rear. This was done after the battle. During the battle many batteries were very far forward, some of the Field Guns being almost in "No Man's Land"; a fierce infantry battle raged for six hours in one battery position. The Austrians had in fact forestalled us in our own attack and found us in our battle positions. On the 16th June and following days the hostile artillery was silent on the Plateau and the hostile forces appeared to be greatly disorganized. A raid by the 23rd Division opposite Asiago brought a large number of prisoners. One somehow felt that could a sudden attack be launched immediately by us great results might be achieved. The Italians however were very worried about their Piave front as the Austrians had crossed on 15th June and occupied parts of the Montello. This temporary success however was eventually the cause of still greater anxiety to the Austrians when our airmen bombed and destroyed their pontoon bridges which had been thrown across the Piave, thus destroying their only means (except by air) of communication and supply. Their discomforture was further increased by the Piave coming down in flood, and disheartened by the continuous counter-attacks of the Italian troops and by the rupture of their communica-

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tions they were forced to withdraw with heavy loss to the eastern bank of the river.

The failure of their offensive was very badly received in Austria-Hungary. Many reasons have been advanced for this failure; possibly they had attacked on too long a front; the attack extended from Asiago to the Sea a distance of 80 miles.

Had the Austrians concentrated all their available attacking forces in the southern Tyrol and attacked between Lake Garda and the Brenta valley their chances of success might have been better. The time of year was most favourable for a concentration in this neighbourhood. There was but a small fringe of table land behind us before we should have been forced to retire down hill towards the plains. As things turned out the Austrians would have captured many guns and much war material could they have penetrated our line to a depth of three miles before 11 a.m. on the 15th June. Up to that hour both the main roads of retreat on the right and left were blocked by fallen trees and shell holes and an ammunition dump had been blown up at Handley cross roads on the left. Communication to the rear was almost non-existent. Owing to the fact that we had alternative lines of defence between the Plateau and the plain and to the natural difficulties with which an enemy attacking down these steep slopes would be faced, the mere fact of pushing us off the Plateau would not necessarily mean a break in the line but it would nevertheless have been a great victory for the Austrians and coming so soon after Caporetto and simultaneously with German victories on the Western front might have caused a panic among the Italian troops holding the Piave line. Any break through on a large scale by the Austrians between Lake Garda and the Brenta Valley would of course involve a rapid retreat and probable disaster to the troops on the Piave line. The Austrian attack, however, was not pushed home with sufficient vigour after the first assault and their reserves appeared to be disorganized. Unlike the offensive of 1917 this time they received no German assistance. Many of the troops and prisoners who had returned from the Russian front showed no inclination to fight and converted others to their point of view.

That this was the last great effort of the Austro-Hungarian army was quite clear. After the 15th June the Allies on the Italian front could turn their thoughts from that of defence to that of attack and could do so with a clear conscience and open mind, it only remained to decide the place, the time, and the means to be employed to bring about the defeat of the Austro-Hungarian armies.

On the British and French front raids in force were carried out on the enemy's lines and intensive artillery fire was brought to bear on his front and reserve lines and on his batteries. It was not until October however that there was any talk of an Italian offensive. What would be the locality selected? here again there were difficulties; an attack northwards over mountains 9,000 feet high was quite out of the question, especially at this season of the year. An attack due east from the Piave would mean a lengthening of an already long line of communication, which was outflanked and threatened from the north

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and would be still further threatened the further east the line was advanced. The point selected for attack was Vittorio Veneto and the line of attack was to be north-east from the Piave avoiding at the same time any attack across mountains and any appreciable lengthening of communications.

British and French troops and artillery were withdrawn from the Plateau and advanced to their new front by night marches. The greatest secrecy was observed. Artillery on arrival in their new position remained silent and did not register prior to the attack. They depended on the Field Survey for the exact triangulation of their positions and of their principal targets.

Reconnaissances were carried out in Italian uniforms. On the Asiago front sufficient British and French troops and artillery remained to conceal the fact that others had been withdrawn. The artillery that remained had only to increase their fire to complete the illusion. All went well with the attack on the Piave and during the last days in October there were signs that the Austrians intended to withdraw from their positions on the Asiago Plateau. They withdrew in a single night leaving their guns and ammunition and most of their trench stores in position. The British 48th Division followed through the Val d'Assa as far as Trent. With the exception of one battery of 6-inch howitzers no heavy artillery went forward. The Austrians were broken and complete regiments surrendered wholesale. On 3rd November many Austrian regiments were already under the impression that an armistice had been signed; one Austrian General who had been hit in the face by a shrapnel bullet came into our lines to enter an official complaint against our action in continuing the battle. Such is the effect of rumour on a beaten army. On the 4th November an armistice was signed between the Allies and Austria Hungary.

NOTES ON THE AUSTRO-HUNGARIAN ARTILLERY.

Up to battery commander inclusive Austrian artillery officers were good. Their shooting was accurate and they seldom wasted ammunition and generally chose their targets well. Their time fuzes were not good and they generally burst their rounds too high, with the exception of the time fuze used with their Field Howitzers. The Austrians did very little destructive counter battery work but employed 305 c/m Howitzers occasionally for neutralizing fire; these howitzers were not very accurate and therein lay their chief danger, that no one knew where the next round would fall. There was generally a complete absence of "indiscriminate shooting" though this may have been partly due to a shortage of ammunition. The higher artillery Commanders did not utilize their artillery power as well as the Germans and their employment of gas shells on 15th June failed signally inasmuch that they attempted to take on too many localities with the result that in no place did they get a sufficiently strong concentration seriously to endanger our troops or hamper our movements. The proportion of guns to howitzers in the Austrian Army was much higher than one would

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have expected from a country whose fighting would be in the mountains. The Austrian system of stopping an attack lay rather in putting down a dense gun barrage on all rearward communications and so stopping the advance of reserves and supplies rather than in putting down a dense howitzer barrage on our forward infantry. For their attack on the 15th June the Austrian artillery moved into forward positions after dusk on the evening of the 14th and opened fire without previous registration. Most of these forward batteries fired on targets in enfilade and on communications where the line was of more importance than the range. The shooting of these batteries was good but some of them suffered severely next day, those that escaped owing their salvation to the rain and mist.

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MEDIUM ARTILLERY AND HORSE TRANSPORT.

BY COLONEL C. F. PHIPPS, D.S.O., R.A.

IN Major Crofton's article in the July "Journal" and in Captain Fisher's essay, there are some points which call for qualification.

With the main contention of the articles that mechanical transport will in the end supersede horse transport for guns, probably most of us are in agreement.

But, while Major Crofton does full justice to the claims of mechanical transport, and founds his conclusions on a reasonable conception of the experience of the Royal Garrison Artillery in this department, he has unfortunately weakened his argument by overstating the case against the heavy draught horse.

I say "unfortunately," because at the present moment the British taxpayer is seriously concerned with the fact that his income tax is six shillings in the pound, and he is very unlikely just yet to supply his army with a good tractor for medium guns, even if there be such a thing. Consequently, the heavy draught horse remains with us as our chief means of transport, and it is of extreme importance that the ideas held by the General Staff, by the instructors at the various schools, and by officers of the other arms, as to the tactical possibilities of medium artillery, should be based on accurate facts proved by our experience of what heavy draught horses can or cannot do. And therefore it does seem a great pity that so able and thoughtful a paper as Major Crofton's should, in this particular, advance views which are contrary to the proved experiences of the war.

For instance, what officer of another arm, after reading the article, could imagine that for years before the war 60 pr. batteries, drawn by heavy horses, marched solidly with their divisions at manœuvres, and that, so far from finding any difficulty in keeping up with other troops, they found the infantry pace too slow for comfort, and marched more happily with columns of light artillery?

Of course during the war many new batteries went out to the various fronts with scarcely any training in driving, and, if they got no further training or experience, probably failed when suddenly called on to march.

But surely we should base our ideas, not on such experience as this, but on our knowledge of what batteries properly trained in peace time did, when subjected to the severe test of 1914; and, indeed, of what our present medium batteries can do.

Surely, if there was anything wrong with the heavy draught horse we should have found it out in the interminable marching in August and September 1914? How is it that this horse, who appears to be classified as delicate by Major Crofton, pulled the 60-pr. day

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by day, and night by night, over the roads of Belgium and of Northern France, in great heat, short of forage, sometimes with scarcely time to water at the halts? How is it that these batteries were able to continue, fulfilling their tactical rôle, marching wherever required by their divisions, sometimes in the advanced guard, up to the time when we settled down to trench warfare?

The reason for the success of the 60-pr. as a mobile medium gun was due to the excellence of the heavy draught horse as a means of transport, to the keenness of the batteries on their horses and to a good system of peace training.

There are many officers who can confirm this, and after all one is not necessarily a *laudator temporis acti* to the point of hide-bound conservatism, if he desires to recognize, and to avail himself of, what is good in the present actual system of transport.

Now what are the facts as to the R.G.A's experience of trained horse-drawn batteries?

There were two brigades, each of three 60-pr. batteries, before the war. Major Crofton seems to consider the absence of a driver establishment to have been a disadvantage. In reality it was not so. During the winter it was possible to put a very large percentage of the gunner establishment through the riding school, especially at Woolwich; the men were really as keen on driver's as on gunner's work; the physique of the R.G.A. gunner made it easier for him to drive a pair of H.D. horses than it is for the small driver. The consequence was that a great many men were thoroughly trained as gunners, layers, signallers, etc., *and* as drivers, and so you got some good all-round men as N.C.O's, who proved their worth in the war, and many of whom obtained commissions and helped in the raising of new batteries.

There were also a good many officers in August 1914, who had served in one or other of the heavy brigades for a term of years; these officers naturally were posted to the new heavy batteries which were formed.

Undoubtedly the training system proved a success in France. So much depended in those days on good driving! and we *had* good driving! I have not worked it out carefully, but I estimate that the marching at the beginning of the war was about 240 miles in 22 days. Some of this was continuous; a battery after taking part in the battle of Le Cateau, left the field about 3 p.m., on 26th August, marched all that night (except for 2 or 3 hours in the middle of the night), and all the 27th and all the night of the 27th up to noon on 28th!

After this came 15 days marching, before the battle of the Aisne gave horses some rest. Yet batteries were never in any danger of not being able to keep their place in the main body or in the advanced guard, and the H.D. horses advanced from the Marne to the Aisne, perhaps not actually neighing loudly, but at any rate making a more cheerful noise than the engine of an F.W.D. would have been doing after that experience!

Neither then nor during subsequent marching, nor during the winters in the horse lines, did casualties or sickness reach a pitch to justify the pessimistic view put forward in Major Crofton's article.

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Of course it will always be the case that hastily formed and partially trained units will be expensive luxuries in respect of their transport, whatever be its nature. This applies equally to R.H.A., R.F.A. and R.G.A., and both to horse and to mechanical transport.

But the point to bear constantly in mind, is that either with horse or good mechanical transport, medium batteries can fulfil, if trained in peace time, the tactical rôle of mobile batteries working with divisions in moving warfare. Officers of R.G.A., owe it to their regiment and to the army that wrong ideas, based on the neglect of experience, should not be allowed to deprive our forces of the aid which can be supplied by mobile medium artillery, and which was supplied in 1914 on a small scale by the British horsed "heavy batteries" and on a large scale to the German army by the German horsed "heavy batteries"!

And now what is our experience in the new R.G.A. Brigades? Major Crofton says that "the rising generation as a whole exhibits a far greater enthusiasm for machinery than for "horseflesh." Is that so? If it is, then why has the issue of officers' chargers and of horses for battery staff pleased the so-called "M.T." batteries so much and given them an enhanced interest in life? How it is that we still see at military horse-shows splendidly turned-out horses from all branches of the service, when it is due to enthusiasm?

In any case the trouble about tractors is that they are not yet there! And when they do arrive, there will always be this disadvantage about them—that they cost a lot more on the move than they do when quiescent in the shed. This the intelligent taxpayer, the brilliant journalist, will soon grasp, and petrol will be doled out like radium, to the great detriment of training in mobility. Whereas the running forage account covers the horse whether in use or not in use.

The question, then, being "To move or not to move," we should examine ourselves strictly and ask ourselves the question—"For the time that *is*, for the interval before we get the ideal tractor of the future, shall we get the best training by using the present establishment of horses, or by borrowing a few old caterpillars or F.W.D's, relics of the war, for a few weeks in each year? Because that is probably how the question really stands for the *present*.

As regards the *future*, we can applaud most heartily the excellent stipulations which Major Crofton lays down and the projects which he advances.

It is a most auspicious sign that the "Journal" should be full of progressive ideas as to mechanical transport. Not the least of the debts which readers of the "Journal" owe to Captain Fisher is the appearance of the word "vector" in its pages. A "vector," I feel sure, would not let us in as a "tractor" sometimes does (and as the H.D. horse does *not*!).—

But in Captain Fisher's Silver Medal Essay we get the same strange assumption that nothing can be done with medium artillery until the horse is abolished. At least, that is how I read his remarks at the bottom of p. 123 and on p. 124.

This is a very mistaken idea; in fact, it is a disastrous idea, because if it once permeates our training institutions, we

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shall find medium artillery excluded for the present from any British mobile force, to the certain prejudice of any chance of success which that force may have. History repeats itself. We read in Lord Haldane's book, "Before the War," that prior to 1914 it was considered that the first battles of the war would be eventually "moving warfare," and *therefore* heavy artillery was excluded!

In spite of this we did actually put in the field six horse-drawn batteries of 60-prs., whose mobility was amply sufficient to enable them to fulfil the tactical rôle of medium artillery. *And* let it never be forgotten that the German horse-drawn medium batteries marched, manœuvred and shot during the rapid advance into France in 1914, with results highly satisfactory to themselves, but no doubt what Captain Fisher would call "far from satisfactory" to our side!

There are many men who can bear witness to these things. It is quite plain that the old idea as to the immobility of horse-drawn medium batteries was proved false in 1914. Then why revive this ancient error? One hears of tactical schemes in which 60-pr. batteries are relegated to march with the divisional ammunition column!

Will Major Crofton and Captain Fisher tell me this? Because the medium batteries ardently desire a new and splendid "vector" (with *lots* of petrol) which will give them still greater mobility, why should they not carry on for the present with the very satisfactory means of transport which they have, the H.D. horse? And why should our army be deprived of the help of mobile horsed medium batteries at the present time, just because there is a "vector" coming some day?

To take up any tractor but the best, would be a retrogade step. Remember April 1917, when the enemy went back to the Hindenburg line, leaving a sea of mud into which *no* mechanical transport could penetrate, but which was negotiated successfully by the horse-drawn 60-prs.! Nothing but the best will do; and in the meantime we can get on with the business; we need not sit down and wait till the flow of invention deposits a supervector at our feet.—*Rusticus expectat dum defluat amnis!*

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SOLDIERING UNDER JOHN COMPANY.

An Officer in the Madras Artillery, 1779-1820.

[BY ONE OF HIS GRAND-DAUGHTERS.]

Reprinted from "the Pioneer Mail," July, 1921.

THERE is a well-known picture by a Scottish artist, Sir Robert Porter, of the taking of Seringapatam, copies and engravings of which are often found in old Scottish families and houses. In it the subject of this memoir is depicted as a Major of the Madras Artillery on the left of the picture, facing the spectator, brandishing his sword as he rushes across the bridge to enter the city, within the walls of which, strewn with dead and wounded, the corpse of Tippoo Sahib was then lying. On the right hand stands a group of superior officers, Lord Wellesley, Lieutenant-General Harris—soon after to become Major Bell's uncle by marriage—and others, who looted Tippoo's body of clothing and jewellery so effectually that, by the time their subaltern could reach it, there was nothing left for his share but the dark blue cotton pyjamas of this fallen foe, which he carried off as a trophy, and they are in the possession of his descendants to this day.

Just a hundred years ago in 1820, General Robert Bell of the Madras Artillery retired to England, after 42 years spent in the East India Company's service, with only one furlough home during the whole of that period.

He had shaken the Pagoda Tree sufficiently wisely and well to enable him to retire with ample means to settle himself with everything handsome about him, with his third wife—a Scots cousin whom he married a few months after his arrival in England—and two unmarried daughters, the youngest of a numerous family. Three sons were left behind him in the Company's service, all in his own corps.

Fashionable Bloomsbury.

He settled in Bloomsbury, where he found congenial society in many retired Anglo-Indian officials, military and civilian, the prototypes of Colonel Newcome and Jos Sedley; first in Gt. Ormond Street, in Lord Chancellor Thurlow's house from whence the great seal was stolen, and then in the new, fashionable quarter of Russell Square. Here he furnished his house in the solid style of that day, and much of the plenishing still survives. Massive silver and Sheffield plate; Copeland and Spode china; English rosewood, and Indian ebony and ivory furniture; lacquer figures, inlaid boxes of all shapes and sizes, antique Indian jewellery, native pictures on talc and metal, all the

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valuable knick-knacks then brought home from the East, including the carved black and white ivory chessmen with which he played a game with one of his daughters every day. Books were not omitted, and there still remains of his library a complete set of the British Novelists edited by Mrs. Barbauld, a 1788 edition of the Spectator in 8 vols., Johnson's Lives of the Poets, and other such books indispensable to a collection of polite literature in those days.

In these surroundings he fulfilled his hopes of spending "the fag end of my life in great domestic comfort," for 24 years, dying at the ripe age of 83 of gout, in spite of his annual visits to Bath and Cheltenham to control the malady.

Seven years after his retirement he began to write a memoir of his life, unfortunately left incomplete; some extracts from which, may be of interest to the general reader, though he promises that he does not intend to take upon himself "the Character of the Historiographer of Indian Warfare, (as) personal recollection is my object."

Birth and Education.

Born in Ireland in 1761 of Scottish parentage, Robert Bell found himself at the age of 17 with small means, and, by the death of a kinsman and guardian, virtually his own master. Like other lads of his own age, Commoners of Trinity College, Dublin, he was attracted by the "placards and highly coloured descriptions of honor and glory literally distributed thro' the Capital," by a Captain Brooke recruiting in Ireland for the East India Company's service, who honestly pointed out to these young gentlemen adventurers the objections to their enlistment as private soldiers. But, when most of them persisted in this resolve he kindly gave them an introduction to the military department of the India House in London where the Committee not only received them well, but sent orders to the captain of the "Calcutta" in which they were to sail for Bengal, to give them separate accommodation from the other privates, and every possible comfort.

The Indian fleet being detained for some days at St. Helen's by contrary winds, Robert Bell was given leave to go to Portsmouth in order to obtain a trunk sent to him there to the "Blue Posts" coach office. The town was so full, owing to a visit from King George III to the fleet at Spithead, that no room could be hired even at a guinea a night, and he was thankful to sleep in one of the coffee-room boxes. What was his dismay, on reaching the shore next morning, to see the Indian fleet—the last of that season—standing out in full sail through the Needles, with no possibility of pursuing it. He was literally stranded with only a few shillings in his pocket, and all his worldly goods, except the small wardrobe in his trunk, on board the "Calcutta," fast vanishing from his sight. In this extremity of despair he wrote at once to his only friend in England, a young London merchant just starting in business, who, by return of post sent him not only a draft for six guineas, a sum he could ill spare, but a more valuable document in the shape of an order from the India House for Mr. Bell to embark in the "Stafford," then ready to convey Sir Eyre Coote to India as the Company's Commander-in-Chief.

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Goes East with Sir Eyre Coote.

Certainly Robert Bell must have been born in Lucky Lane, for this apparently crushing disaster in the loss of his first ship turned out greatly to his advantage, Sir Eyre Coote and his brother-in-law the captain of the "Stafford," showed the gentlemen privates every kindness: "On many occasions we received a joint of mutton, or fresh pork, or a fat goose in addition to our ship allowance, besides the services of one of the recruits to attend our mess, and the privilege of the quarter deck." Great alleviations in a six months' voyage! At Capetown they were allowed to go ashore—"and boarded sumptuously for one dollar a day." Finding they had caught up the Indian fleet, then lying in Simon's Bay, Bell with some of his comrades walked there—"a distance of 24 miles on a deep, sandy road "—and back the next day, after recovering his property from the "Calcutta."

The rest of the voyage was uneventful till "speaking a ship from Madras we learned that a large army there was preparing for the siege of Pondicherry." This induced the Commander-in-Chief to proceed direct for Madras instead of Bombay, "with the hope no doubt of again having the honor of taking that Fortress." (Pondicherry had surrendered to Colonel Coote in 1761), "but on arriving in Madras Roads on the 31st December, 1778, we learned that Pondicherry had already surrendered' to Sir Hector Munro on the 18th October, to the natural disappointment of Sir Eyre Coote.

Arrival at Fort St. George.

The gentlemen recruits found good quarters prepared for them in Fort St. George, where the Town Major, Captain Sydenham, had pitched "one large tent with 4 large cots and the necessary furniture, and in another Mess tent, a table with 4 covers and a reasonable supply of wines. A line of native servants, headed by a venerable butler, wearing enormous gold earrings, spread the table with an abundant variety of food, followed by a dessert which to us appeared magnificent,"—and the young men found themselves at once in clover!

Next morning, having made the best of their limited wardrobes, they appeared before the committee to decide their fate, and were ordered to the Artillery headquarters at St. Thomas' Mount, 8 miles out of Madras, so called after the apostle who was supposed to have preached there, and soon received their commissions. Two days later they had their first invitation to dinner—at one p.m.—from Captain Kennedy of the Artillery and his wife. When Mrs. Kennedy had withdrawn from the table, and the host was ready for his after-dinner nap, "he filled his glass, and, pointing it to us, said, 'Good afternoon' —the usual signal for breaking up a party." Not understanding this the four cadets sat on through a repetition of the toast, and had finally to be bowed out, with an invitation to return to supper, as was the hospitable custom of those days. Mrs Kennedy, "not recollecting the names of her new acquaintances, designated them to a friend in a way too flattering to my vanity to be omitted, as the tall Cadet, the short Cadet, the ugly Cadet and—the handsome Cadet."

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The Handsome Cadet.

Few traces remain of this appellation in the pastel portrait and miniature of Major Bell, painted on his return to England in 1706 by Russell, R.A., though they show he had preserved fine, clear blue eyes, and a long, well-shaped nose, and wore his own scanty grey hair.

Early in 1779 an introduction, sent from Ireland to a kinsman, Colonel Ross Lang, produced an invitation to visit him at Vellore, with an order for 50 pagodas (a coin then worth about 8 or 9 shillings), a most timely gift, as it "enabled me to equip myself completely and to afford assistance to my companions, none of whom were so fortunate as myself. As early as was possible to save such a sum, I returned the 50 pagodas to General Lang, then Commander-in-Chief, who accepted it"—"to my disappointment," he naively adds, and continues: "It has been a pleasing reflection to me that I have been enabled without any other assistance to keep out of debt."

Considering that a Second-Lieutenant's pay was then under 20 pagodas a month, and that he was not made full Lieutenant till nearly three years later, this proper pride may well be excused.

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PRIZE ESSAY.

"Does the Scientific future of the Regiment necessitate the formation of a special branch of Artillery Experts who shall be sent, on commissioning, to the Artillery College for continuous training in Experimental and Research Work."

BY COLONEL F. M. RICKARD.

"Does the Scientific future of the Regiment necessitate the formation of a special branch of Artillery Experts who shall be sent, on commissioning, to the Artillery College for continuous training in Experimental and Research work?"

At first sight the answer which suggests itself is "No"—for to form yet another scientific, or rather technical, unit would perpetuate the tendency, which seems to be prevalent at the present moment, for each corps to try to run independently, and would eventually emphasise the want of co-ordination such a scheme seems sure to involve, as well as the failure inherent in any attempt to work in water-tight compartments.

But on looking at the question from a different angle, the inclination arises to give a diametrically opposite answer, since how otherwise might the value of scientific study and technical research receive the attention nowadays necessary, and how otherwise would recognition be given to the claims of those who had surrendered an active military career for the sake of technical work?

It would seem that the true solution is to be found only in a happy mean between the two diverse views; and the fundamental answer to the whole question appears to lie wrapped up in the all important subject of the education of artillery officers in general, so that the desire for technical knowledge and the appreciation of its value may permeate throughout the whole regiment and not be looked upon as the prescriptive property of the few who, owing to natural talent or from force of circumstances, have succeeded in pushing open a half-closed door.

On the one hand, if the provision of technically trained officers remained on the same basis as at present, the supply would continue to be precarious. The inclination with some would be roused only by a personal interest or bent for technical work;—with others possibly the incentive would remain other than the lure of science. And the present

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inducements are not sufficient to persuade the majority to embark on a course of severe mental training,—for to value a branch of study we must consider—

(i). Not merely what it gives us—
(ii). But also what it deprives us of, by engrossing our time.

On the other hand, if the experts be trained in a special branch from the commencement of their career, the risk is run of creating a school of thought more theoretical than practical, which, in the nature of things, must remain divorced from the service manner of thought, since these experts will not have obtained actual experience in the handling of equipments, but have come into touch with the practical requirements of the service only indirectly. And this state of affairs would be likely to raise in the mind of the regimental gunner a feeling of disquiet regarding a possible lack of sympathy, if not of distrust of theoretical ideas which might be of no use in the carrying out of every-day work.

With scientific work connected with, and so dependent upon, a practical service which imposes its own limitations, it is necessary not to lose sight of the most important point that technical artillery work possesses peculiar characteristics, and for that reason requires an administration quite distinct from that of such work in connection with commercial enterprises, since the limitations and application are dictated by very different conditions and to be effective should be carried out in close touch with service requirements.

Surely every artillery officer should be well acquainted with the principles upon which depends the smooth working of every portion of his equipment, whether it be a mechanism, an hydraulic system, or an electrical contrivance!

What motorist nowadays is not largely independent of the specialist?

The experience of the Great War has taught us that it is not wisdom to rely entirely upon the specialist to maintain the efficiency of artillery equipment.

If only all officers had been as skilled in the scientific branches of their work as in the military portions, many unnecessary accidents and consequent expenditure could have been obviated.

There is high importance in educating the regimental artillery officer so as to be able to discuss the advantages and disadvantages of artillery equipment; and by reason of his education and practical experience the opinion of the artillery officer should be of great value in all questions relating to efficiency of artillery material. Moreover, if the artillery officer has not technical knowledge to combine with his every-day work, he will not be able to understand the application of some new scientific discovery sufficiently to manipulate it. And unless he has technical knowledge he cannot take in his equipment the interest which should be demanded of him.

Technical education has become a necessity to the regimental artillery officer, and this combined with actual practical experience of

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service requirements makes the regiment the best recruiting ground for the technical departments. But to make this recruiting ground a profitable source of supply, it is necessary to make an appeal very much stronger and more to the point, than has been done in the past.

In three ways must the regimental officer be influenced :—

1. He must be brought to appreciate not only the necessity for technical education generally, but also the value of the work performed in the technical departments.

2. It must be made clear to him that the instruction given as introduction to a technical department is of the nature of real education, and his mind must be disabused of any idea of a course being a period of "cram" for an examination.

3. He must be assured that there are prospects for officers of the technical departments both in beneficial rates of pay and in assured promotion.

1. The interest in technical work, apart from any individual desire or personal bent, aroused amongst artillery officers in general, cannot be said to be more than very small. The reason and cause of this are due to a lack of any incentive.

Looking at the matter from a wholly unbiassed point of view and with an unprejudiced eye, it is impossible to disguise, even under a cloak of equivocation, the fact that the professional education of the gunner of to-day has been built up piecemeal; not with a prearranged final completion to be arrived at, but rather with the idea of doing the best under the circumstances of the time being and to suit the requirements of the moment. No doubt, and with justice, the fault may be attributed to what might be termed a stage of transition, particularly with reference to scientific application. But still the fact remains that this garment of education is very like a ready-made coat, cut down here and let out there, so that it may look fairly well upon the back of the wearer and be more or less presentable to the public gaze, though perhaps the individual, who wears it, alone knows how uncomfortable it is, and that it does not and never will fit.

Activity of mind is natural in man and if the fair promise of youth be often not fulfilled, it must be attributed rather to defective education than to want of natural power. It is fairly certain that if interest be not roused and maintained, incentive will not be born. And this infusing of interest must commence from outside the individual; the incentive must be inspired by others or the example of others. It is not sufficient to limit an officer's knowledge to the one mechanism which happens to be in his charge. He must be imbued with a desire to appreciate artillery as a science, and be able to compare the effectiveness of his equipment with other natures, foreign as well as British. He must be induced to understand that on himself depends whether his equipment is as efficient as it should be. And the more he is induced to study and understand his equipment, the more must he be persuaded to undertake the care of it.

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We want from all artillery officers, an intimate acquaintance with all the material in their charge, with the regulations for keeping it in repair, and with the ordinary reasons for its falling into disrepair.

All this requires instruction. However, it is not the matter of instruction that is in dispute but the method to be employed, the opportunities to be afforded.

If it be granted that every artillery officer should be mentally equipped with knowledge of artillery material, requisite for a thorough understanding of his equipment as well as for capability in imparting this knowledge to those under him, it is only just that he should be given not only opportunities for study but also opportunities for maintaining his knowledge. And the opportunity for study should not be merely provided, and the officer left to take advantage of it or not as he found convenient; the instruction so provided must be of an obligatory nature, in order to impress upon each and everyone not only his immediate needs but also the immense scope that lies open for study.

Thus and thus only would a general interest be aroused.

Some hold that all instruction should be given to officers while with their units. Though, perhaps, information regarding a single equipment can be thus obtained, the study of artillery cannot be efficiently carried out with restricted facilities. More is wanted in the direction of greater completeness of knowledge; and probably the technical education of most officers wants amplifying. And here comes in the value of the Artillery College which would give officers an opportunity for improving their technical knowledge in the light of modern ideas, and for studying the latest scientific applications to artillery material.

It is seriously suggested that a great mistake is made in keeping so distinct the Advanced class and the Gunnery Staff course. If these two were combined for the first year, though the knowledge gained might not be of immediate use to the students for Gunnery Staff, Inspection or Research Departments respectively, yet the general education could not be otherwise than of value. For this, the experience of the Great War stands witness. To the Inspection Department, practice camp experience, and to the Gunnery Staff, knowledge of manufacturing methods must be of value. And moreover, a closer liaison would be established between the practical and theoretical gunnery authorities.

If every artillery officer after 5 or 6 years of regimental work, at a time when he can appreciate what he is studying, were obliged to attend a year's course as suggested above, not only would he learn that the Artillery College and the Gunnery School are not favoured preserves, but his interest in technical matters would be aroused; so that on return to regimental duty his value as an artillery officer would be greatly improved, particularly if a favourable result of the course were a certificate for promotion.

The educational problem is extremely important, since, without some scheme of technical education, it must remain impossible for

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regimental officers efficiently to take charge of complicated artillery material.

But a technical course will be of no avail if no practical use be made of the knowledge acquired. And here there is a great opening. Under existing circumstances the regimental officer fears he may be held responsible for any damage he does if he attempt to interfere with the armament, and he hesitates to invade what is now the sphere of specialists. If every artillery captain, having satisfactorily passed a year's course at the Artillery College, became an authorised person for the regular examination of the equipment under his charge, a great benefit would be conferred upon artillery officers in general. It is not suggested that I.O.Ms. and I.O.Os. should be supplanted; but it is suggested that they should be considered only as authorities for reference and not as authorities for carrying out the regular periodic inspections.

All artillery officers of 6 or 7 year's service, probably of the rank of captain, should be eligible to be called upon, at any moment, to examine artillery equipment and to remedy defects. And this requirement would have all the more force during war time.

It is felt that such a scheme would usefully enlarge the sphere of the regimental artillery officer; would rouse his interest in the science of artillery; and would create incentive sufficient to preclude all doubt as to the forthcoming of a supply of officers anxious for employment in the technical departments.

2. The strenuous work necessary on a course under present circumstances involves a state of "cram" which cannot be called real education; and this severe strain is probably a deterrent to many who possibly would be students.

Necessarily the education provided by courses must be limited by the time allowed, so that only main principles can be dealt with in order to lay a foundation upon which an officer can build, as he will still have much to learn after taking up an appointment. Possibly this is not clearly understood generally; but the position should become clear to all who passed the proposed general course of a year's instruction.

Most men are inclined to read, but are opposed to any suggestion of competitive study. And it is open to question whether it is fully realised that study at the Artillery College need not be a "cram" to pass an examination. But it is also open to question whether the manner of instruction at the Artillery College cannot be made more attractive to a student who wishes to study rather than compete for place. After all, the man who can apply real study is of more value than the man who cannot rise above scoring place-marks. It is, of course, understood that examinations form a convenient test; but there is danger in useless erudition, incompleteness in toiling and labouring to stuff the memory while leaving the conscience and understanding unfurnished and void: and the mere imparting of information will not unite itself with the individual consciousness unless it be combined with the practice of analysis.

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The scope of instruction at the College should be expanded to allow of teaching by practical experience and enquiry. The authority of the official treatises and text-books is of no value by itself, unless reasons be there also; no rule nor notion will be implanted in the mind unless it has been verified and found correct by proof. And further, the range of the activities of the College should be such as to enable it to be not only the professor for instruction of classes, but also the guide and adviser of all regimental officers.

The aim should be to kindle in the minds of all artillery officers a great respect for the Artillery College, and a regard for it as an authority on technical subjects, and thereby to infuse a desire for a closer rapport.

And in order that the College may gain such repute with the regiment in general, it is necessary that confidence in the instructional staff should be inspired in all. Such confidence cannot be diffused if the status of the instructional staff be considered lower than the status of other technical departments.

Not to mince words, position on the instructional staff should be considered as promotion from other technical departments, and the emoluments should be at correspondingly higher rates. Those who have charge of the instruction of officers about to take up appointments in technical departments, should themselves have previously had personal practical experience in those departments. Without such practical experience the teacher cannot realise to the full the needs of the pupil; and until the instructional staff is placed in a position of proper relative importance, it cannot be expected that the requirements will be represented with that assurance needed to carry weight, nor the representations be met with that confidence requisite for fulfilment.

Moreover, for the greater benefit of the College and consequently for the Regiment and the Service, a close liaison should be established and maintained with other schools and scientific instructions, such as the Naval Schools, the Air Force School, the Universities of Oxford, Cambridge and London, the Institution of Mechanical Engineers, etc.

3. Though at the end of the proposed year's course for artillery officers in general, the majority would return to regimental duty, the classes for continued study for the Advanced class and the Gunnery Staff would be selected from the students on the general course.

It would probably have beneficial effect if officers appreciated that good work done on the general course would be the passport to study for the technical departments.

At the end of the general course the special classes would pass on to their distinctive study. Undoubtedly this suggestion would involve an extension of the time for the courses, but it is urged that the time now allowed is far too short, with the result that subjects are not properly dealt with. It is even suggested that the time for the Advanced class should be further extended to allow of an additional period for specialising work.

Before forsaking a career in one direction, it is natural to estimate the prospects in the other direction, and the points to be taken into account would be—

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(a). The comparative rates of pay.
(b). The likelihood of continued employment.
(c). The chances of promotion, and advancement.

It is only natural that there should be an expectation of higher rates of pay commensurate with the higher class of work, of compensation for the deprivation of former freedom necessarily given up on account of the greater amount of work to be done, of remuneration for devotion to the continued study involved.

Since there seems to be now some difficulty in maintaining the supply of officers for the technical departments—it could be argued that the rates of pay are not sufficiently high to be attractive. "Make it worth their while" might be said to be the complete answer. Though there are more points in the solution than the one of pay, undoubtedly that one is very important, as being a serious determining factor in the decision to give up pursuits perhaps more interesting than technical work.

The likelihood of continued employment has a decided influence in the selection of a career, for it is hardly to be expected that a man will exert himself to his best and continue to do so, unless he feels that his efforts are going to bear fruit which he will see ripen and so benefit by. The chance periodic tour of work cannot be so fully attractive as continued employment in that work.

Though the chances of promotion to the highest ranks may not have so much influence so long as there be equable compensation in the matter of pay, yet that there should be less opportunity for attaining to high rank and high position does affect the case for an ambitious man.

It is very difficult to separate the points which affect the decision and they must have a collective influence.

At present the source of supply is limited to those who voluntarily offer themselves, and who are taken for want of any better. It is not suggested that any scheme for an obligatory supply would be better, but it is represented that the voluntary supply would be much larger if interest in the subject were more widely spread.

The present supply is not sufficient for our needs, there is no margin, there is no power of expansion.

To give effect to the desire to establish on a sounder basis the provision of officers for the technical departments, it is necessary to adopt means whereby the supply will always be coming forward in a regular flow and not be dependent upon any promiscuity.

To obtain a reliable crop it is essential to prepare properly the ground—the recruiting ground,—and on the receptive soil liberally sow the seed— the seed of technical education throughout the regiment,—and from the crop then obtained, sift out the best for refining—the refining of further instruction,—and subject this best to a further refining—the trial of an actual tour of work in a technical department. If this best then prove worthy, garner it.

If some scheme be established by which technical education is accepted as a necessary qualification in every artillery officer;—by

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which an officer can follow a course of training, not special or exclusive, but organised on general lines;— and by which he can appreciate the benefit not only to the regiment but also to himself,—then there will eventuate reliance in, and control over, the supply of officers for the technical departments.

The suggestion, here put forward, is as follows :—

After passing satisfactorily through the advanced instruction at the Artillery College, an officer should be employed in a technical department for a tour shorter than is now usual—say for 3 years; and during that time the very best should be demanded of him, as this employment should be a real test of his capabilities. And if this demand be strictly insisted upon as involving any consideration for further employment, the rates of pay must be made such as to permit the enforcement of such a demand.

After this first tour of employment the officer should return to regimental duty for a short period. And if that officer be considered to have proved himself and to be worth further employment on technical work he should, when appointed to a second tour, be retained permanently for such work. The prospect of continued employment would thus be materialised;—and in such a manner a technical branch of approved value would be formed.

The organisation of this technical branch could be carried out by forming—either

(i). A permanently seconded list, or
(ii). A separate technical corps.

In the first case, the officers on the list, not being removed from the regiment, would remain governed by the same rules for promotion and retirement as the regimental officer, except that examinations for promotion should be abolished for this seconded list. And, as a reward for the valuable service in this technical branch, certain high positions in the War Office, such as Director of Artillery and Master General of Ordnance, being connected with technical work, should be considered as posts to be filled from the technical branch.

In the second case, the corps would require to include all the officers holding appointments in the M.G.O's department at the War Office, the Ordnance Committee, Artillery College, Ordnance Factories, Inspection Departments Woolwich and Enfield Lock, Research Department and Experimental Department. But it is doubtful whether the total number of officers would form a corps large enough to permit of promotion, within itself, regular and rapid enough to be popular, or to require a regular yearly influx so necessary to maintain interest in the technical departments. Moreover probable variation from time to time in the establishments of the several departments would disturb and very likely upset matters too seriously.

To sum up—

1. It would be a mistake to start a special branch separate from the regiment on first commissioning.

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2. The regiment forms the best recruiting ground, owing to the knowledge of service requirements.

3. The regimental officer requires technical education, so why not use him and put him into much closer touch with the technical departments.

4. Teach the regimental officer, so as to infuse interest in technical knowledge, to inculcate regard for the Artillery College, and to instil desire to participate in the work of the technical departments.

5. Select from general courses, the officers for further study for the technical departments.

6. Place officers, selected for a second tour of employment, on a permanently seconded list.

7. Raise the rates of pay of technical officers to such a degree as will not only permit of a strict insistence on the best of work, but also, particularly in the higher ranks, compare equably with incomes in the civilian world.

8. Raise the status and pay, and enlarge the scope of the Artillery College.

9. Hold open some high appointments for technical officers.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—October, 1921.

I. Operations of the Belgian Army, 1914-1918. (Continued).
II. Cavalry of the past and future. Lt.-Genl. Joostens.
III. The Problem of Tactical Security. (Applied to modern conditions). Lt.-Col. van Emelen.
IV. Ground Observation of Artillery Fire. Lt.-Col. Grade.
V. Modern Searchlights. (Continued). Major Pirot.
VI. Gas Warfare. (Concluded). Dr. de Sillevaerts.
VII. The Reduction of Machine Gun Nests. X.X.
VIII. Notes on Armoured Cars. (Concluded). Cap. Comdt. Van-der Donckt.
IX. The Supreme Command during the Great War. Cap. Comdt. Terlinden.

(A 15 page review of "At the Supreme War Council." By Capt. Peter Wright).

X. Notes on Foreign Armies.

Germany.—A general appreciation of the disarmament of Germany, finishing with a comparison of the military and naval strengths in 1913 and 1921.

France.—Army estimates for 1922.

Training.—The scope of the Artillery school at Metz (Centre d'études tactiques d'artillerie de Metz) and the "Cours supérieur technique de l'artillerie à Paris" and other schools.

France.

Revue Militaire Générale.—September, 1921.

I. England and Russia. Maj. Grasset.
II. The first Episode of the Eastern Campaign. (Operation of Koum Kale, 25-26 April, 1915). Reginald Kann.
III. Remodelling of Regulations and our War Teaching. IV. Lucius.
IV. The mishaps of a Marshal of France. I. (Villeroy, one of Louis XIV's Marshals). Col. Revol.
V. The Rôle of the High Command from the Economic Point of View, from 1914—1921. I. Pierre Bruneau.
VI. Books reviewed :—

War recollections of M. Erzberger.

A Journey to Persia during the Russian Revolution. By M. Martchenko.

Revue d'Artillerie.—September, 1921.

I. Questions affecting Heavy Artillery. Lt.-Col. Charet.
II. The Maximum Range attainable from a Gun of given length. Maj. Maurin.

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III. The Dawn of Triumph. Maj. Brun.
IV. Fire Tactics. (Continued). Col. Cambuzat.
V. Evolution of German Artillery Material during the War.
VI. The German Artillery Firing Manual. (Continued).

October, 1921.

I. The Preparation of Heavy Field Artillery Fire. Capt. de la Hellerie.
II. Laws Governing Pressures and Temperatures. Garnier.
III. Average Atmospheric Conditions with Relation to Altitude. Garnier.
(Tables for calculating trajectories).
IV. The Dawn of Triumph. Maj. Brun.
V. Horse Management in a Field Artillery Group during the War. Vet. Maj. Gouyrand.
VI. Fire Tactics. (Continued). Col. Cambuzat.

Switzerland.

Revue Militaire Suisse.—September, 1921.
I. Reflections on the War in Anatolia. Col. Feyler.

GIFTS AND PURCHASES DURING THE MONTH OF OCTOBER, 1921.

Books Presented.

By The Authors.

29th Divisional Artillery War Record and Honours Book, 1915-18. By Lt.-Col. R. M. Johnson, C.M.G., D.S.O. Woolwich (R.A.I.) 1921.

The History of the 33rd Divisional Artillery in the War, 1914-1918. By J. Macartney-Filgate, late Major, R.F.A. (S.R.) London, (Vacher & Son) 1921.

By The Publishers.

The Chronicles of a Gay Gordon. By Brig.-Genl. J. M. Gordon, C.B. London (Cassell & Co.) 1921.

Books Purchased.

From Private to Field-Marshal. By F. M. Sir W. Robertson. London, (Constable) 1921.

The Blocking of Zeebrugge. By Captain A. F. B. Carpenter, V.C., R.N. London (Herbert Jenkins) 1921.

Manuel d'Artillerie Lourde (Materiel). By Col. Alvin and Commdt. Andre. Paris (Charles-Lavauzelle) 1919.

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REGIMENTAL LIST. The following Postings have occurred during the period 20th September, to 15th October, 1921.

Postings.—R.H. and R.F.A.

Beddington, Lieut. H. L. V., from I. Bde. R.H.A., to 63rd Bty. R.F.A. 13/10/21.
Bedford, Lieut. W. J. R., from Staff, to 5th Bde. R.F.A. 4/10/21.
Brownhill, Lieut. C. N., M.C., from IV. Res. Bde., to att. V. Bde., R.H.A. 10/10/21.
Cammell, Capt. G. A., D.S.O., M.C., from G.S. Course, unposted, to 89th Bty., Woolwich. 23/9/21.
Carkeet-James, 2nd Lt. C. A., from India, to 40th Bty. 4/10/21.
Chalkley, Lieut. R., from 132nd Bty., Woolwich, to 3rd Bde. Ammn. Col., Rhine. 30/9/21.
Chilton, Capt. T. C., M.C., from India, to 145th Bty., Bangalore. 6/9/21.
Dannatt, Lieut. A., M.C., M.M., from India, to H.Q. 20th Bde. 4/10/21.
Darling, Lieut. E., M.C., from India, to 99th Bty. 4/10/21.
Drew, Lieut. A., from 1st Bde. R.H.A., to "J" Bty. R.H.A. 14/10/21.
Duke, Major B. L., D.S.O., O.B.E., from G.S. Course unposted, to III. Res. Bde., Gosport. 23/9/21.
Durie, Major T. E., D.S.O., M.C., from 19th Bde., to Unposted. 14/10/21.
Eliot, 2nd Lt. W. E. C., on 1st Appointment to 28th Bty., Deepcut. 22/9/21.
Emberson, Lieut. A. W., from unposted, to II. Res. Bde. 15/10/21.
Ettlinger, Lieut. E. S., M.C., from R.E. Mounted Depôt, to Unposted. 4/10/21.
Fulcher, Capt. (D.O.) G. E. T., from 4th D.A.C., Mhow, to R.F.A. Depôt, India. 29/9/21.
Gardiner, 2nd Lt. R., from India, to 133rd Bty. 4/10/21.
Gordon, Lieut. A. W. K., M.C., from India, to 67th Bty. 4/10/21.
Grice-Hutchinson, Major C. B., D.S.O., from 23rd Bty., Aldershot, to R.F.A., India. 22/9/21.
Harvey, Capt. H. le F. F., M.C., from India, to 117th Bty., Cawnpore. 30/9/21.
Ingram, Lt.-Col. J. M., D.S.O., from IV. Res. Bde., to 14th Bde. 14/10/21.
Johnson, Major (Bt. Lt.-Col.) R. H., D.S.O., from 144th Bty., Bulford, to R.F.A., India. 22/9/21.
Kaye, Capt. G. L., M.C., from 28th Bty., to 138th Bty. 10/10/21.
McCartney, Lieut. (D.O.) L. J., from III. Depôt R.F.A., Gosport, to R.G.A., Pembroke. 29/9/21.
Mansell, Lieut. R., from Staff, to 80th Bty., Bulford. 30/9/21.
Myburgh, Capt. P. S., D.S.O., M.C., from India, to 4th D.A.C., Mhow. 16/9/21.
Pepper, Lieut. (R.M.) H., from Mesopotamia, to II. Res. Bde., Preston. 23/9/21.
Popham, Lt.-Col. G. L., D.S.O., from IV. Res. Bde., Woolwich, to 17th Bde. 21/9/21.
Poston, Major (Bt. Lt.-Col.) W. J. L., D.S.O., from Staff, to Unposted. 3/9/21.
Roantree, Lieut. F. F. D., from India, to 134th Bty. 4/10/21.
Rolleston, Major A. G., O.B.E., from G.S. Course unposted, to 79th Bty. 29/9/21.
Shoosmith, 2nd Lt. S. N., from India, to 114th Bty. 4/10/21.
Snook, Lieut. R. J. B., from India, to 101st Bty. 4/10/21.
Stewart-Cox, Capt. A., from IV. Res. Bde., to 28th Bty. 10/10/21.
Temple, Capt. G., M.C., from 117th Bty., to 113th Bty. 28/9/21.
Turnbull, 2nd Lt. D. J. T., from 137th Bty., to 59th Bty. 3/10/21.
Wark, Capt. (Rd.-Mr.) F., from India, to H.Q., 2nd Div. Arty. 4/10/21.
Way, 2nd Lieut. A. B. M., from India, to 115th Bty. 4/10/21.
Williamson, Major H. N. H., D.S.O., M.C., from 17th Bde., to 109th Bty. 24/9/21.

Cancellation.

Scott, Lieut. A. C., posting to India dated 14/9/21, cancelled 19/10/21.

Postings.—Royal Garrison Artillery.

Alford, Major A. C. R., from Staff, to Adjt., Sussex R.G.A., T.A. 5/10/21.
Armstrong, Capt. R. A., from 45th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Awdry, Lieut. R. J., from 49th Pack Arty. Bty., to 7th Medium Bty. 22/8/21.
Barker, Major C. H., from temp. half-pay, to North Irish. Coast Defences. 22/9/21.
Burke, Major (Bt. Lt.-Col.) H. F., D.S.O., from Staff, to Sierra Leone. 29/9/21.
Candy, Lieut. A. H. J., M.M., from Staff, to 62nd Coy. 1/8/21.

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R.G.A. Postings.—*Continued.*

Carrington-Sykes, Major M., M.C., from Dover to Aden. 11/10/21.
Crane, Capt. R., from "P" Coast Bty., to Sierra Leone. 19/6/21.
Davies, Lieut. J. R., M.C., from 49th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Davies, Major L. M., from Pack Arty Training Centre, to Frontier Garr. Arty. 30/9/21.
De Kantzow, Capt. J. E., from Malta, to "S" Coast Bty. 7/10/21.
Dickson, Major J. McA., from H.Q. Irish Comd., to G.S. Course unposted. 24/9/21.
Eastwood, 2nd Lieut. R. B., from II. Res. Bde., to Att. I. Pack Arty Bde 3/10/21.
Gill, Capt. R. C., from Pack Arty. Training Centre, to 36 Bty. Pack Arty. 30/9/21.
Hamilton, Capt. H. A., from 49th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Hearn, Lt.-Col. H. S., from Tees & Tyne, to Ceylon. 1/10/21.
Hennessy, Lieut. T. F., from 46th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Herron, Lieut. R. L., from Pack Arty. unposted, to H.Q. 6th Pack Arty. Bde. 30/9/21.
Jackson, Lieut. J., from "A" Coast Bty., to Ceylon. 1/10/21.
Jones, Lieut. P. H., from 4th Pack Arty. Bde., to Pack Arty. unposted. 30/9/21.
Jordon, Lieut. A. H., D.C.M., from I. Res. Bde., to Portsmouth. 29/9/21.
Knight, Major J. H., from 45th Pack Arty. Bty., to 22nd Pack Arty. Bty. 30/9/21.
Lamb, Major B., from Shoeburyness, to H.Q. Irish Comd. 24/9/21.
Langhorne, Lieut. E. W., from Pack Arty. Training Centre, to Pack Arty. unposted. 30/9/21.
Leslie, Capt. A. J. R. M., from Adjt. Dover, to Adjt. Singapore. 24/9/21.
Lyons, Lieut. J. M., M.C., from Staff, to 42nd Pack Arty. Bty. 23/9/21.
Lysons, Lieut. H. D., from 40th Pack Arty. Bty., to Frontier Garr. Arty. 30/9/21.
MacLeod, Capt. M. W. M., D.S.O., from 46th Pack Arty. By., to 34th Pack Arty. Bty. 30/9/21.
MacLeod-Carey, Lieut. C. C. M., from Pack Arty. Training Centre, to 28th Pack Arty. Bty. 30/9/21.
Maitland-Addison, Major (Bt. Lt.-Col.) J. F. R. N., from Thames & Medway Defences, to Plymouth. 10/10/21.
Maltby, Lieut. H. P., from 46th Pack Arty. Bty., to 26th Pack Arty. Bty. 30/9/21.
Matterson, Major L. G., from I. Res. Bde., to "I" Coast Bty. 22/9/21.
Minchin, Lieut. R. P., from 46th Pack Arty. Bty., to 21st Pack Arty. Bty. 30/9/21.
Mitchell, Lieut. G. W., from 8th Pack Arty. Bty., to 17th Pack Arty. Bty. 1/8/21.
Moore, Lieut. F. V., from "O" Coast Bty., to Singapore. 5/10/21.
Nugent, Lt.-Col. G. R. H., O.B.E., from unposted to Tees & Tyne. 15/10/21.
Palin, Lieut. G. T., from 45th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Parsons, Lieut. A. R. E., from Pack Arty. Training Centre, to 39th Pack Arty. Bty. 30/9/21.
Peart, Lieut. J. C. B., from 40th Pack Arty. Bty., to 34th Pack Arty. Bty. 30/9/21.
Pellew, Major V. H. L., M.C., from "J" Coast Bty., to Hong Kong. 11/10/21.
Poland, Lieut. R. H., from 21st Pack Arty. Bty., to 26th Pack Arty. Bty. 30/9/21.
Pratt, Major (Bt. Lt.-Col.) E. R., M.C., from Staff, to Att. 4 Depôt. 30/9/21.
Ramsay, Major (Bt. Lt.-Col.) H. A., D.S.O., from "I" Coast Bty., to Malta. 21/9/21.
Rybot, Lieut. F. J. C., from II. Res. Bde., to Att. I. Pack Arty. Bde. 28/9/21.
Smith, Lieut. G. S. B., from 45th Pack Arty. Bty., to 40th Pack Arty. Bty. 30/9/21.
Snowdon, Major H. S. K., D.S.O., from 46th Pack Arty Bty., to 40th Pack Arty. Bty. 30/9/21.
Stanbridge, Maj. W. J., from 49th Pack Arty. Bty., to Pack Arty. unposted. 30/9/21.
Stansfeld, Capt. L. R., from 46th Pack Arty. Bty., to 40th Pack Arty Bty. 30/9/21.
Trenchard, Major G. B. B., from "L" Coast Bty., to "N" Coast Bty. 10/10/21.
Walker, Capt. M. G. E., D.S.O., from Staff, to Gibraltar. 11/10/21.
Ward, Lieut. L. R., M.C., from 46th Pack Arty. Bty., to Att. 7th Pack Arty. Bde. 30/9/21.
Warner, Capt. H. H. M., from "M" Coast Bty., to H.Q. Irish Comd. 21/9/21.
Watkinson, Lieut. G. L., from 30th Pack Arty. Bty., to H.Q. 7th Pack Arty. Bde. 30/9/21.
Wolfe-Murray, Lieut. D. K., from I. Res. Bde., to Portsmouth. 29/9/21.
Wright, Lieut. T. L., from II. Res. Bde., to Att. 1st Pack Arty. Bde. 27/9/21.

Cancellations.

Kaye, Lieut. J. W., posting to 1st Pack Arty. Bty. dated 19/8/21, is cancelled.
Ross, Major C., O.B.E., posting to R.G.A., Malta, dated 30/8/21, is cancelled.

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Staff Appointments.

Royal Artillery.

Mackenzie, Col. G. B., C.B., C.M.G., D.S.O., Colonel R.A., Scottish Comd. 20/8/21.
Wilkinson, Col. M. L., Supt. of Design, Woolwich Arsenal. 1/5/21.
Wilkinson, Col. M. L., Ex-Officio Member, Ordnance Committee. 15/10/21.

Royal Horse and Royal Field Artillery.

Alban, Lieut. A. H. A., D.F.C., Appointed to the Egyptian Army. 30/8/21.
Barrow, Lieut. R., Att. Officer, A.G. 10 War Office. 8/10/21.
Barter, 2nd Lt. A. R., Cipher Officer, Iraq. 4/10/21.
Black, Lieut. C. McC. seconded to Tank Corps. 8/9/21.
Bontor, Lieut. A. A., M.C., Attached to R.A.S. Corps. 30/9/21.
Cameron, Major C. A., C.B.E., D.S.O., Seconded for Special Employment. 6/9/20.
D'Arcy, Capt. J. C., M.C., Garrison Adjutant, Ludd. 29/7/21.
Jones, Lieut. H. C. F., Att. Officer, A.G. 3. War Office. 1/10/21.
Loader, Lieut. W. R., M.C., Provost Branch, Rhine Army. 10/2/21.
Neville, Lieut. C., M.C., A.-D.-C. to G.O.C., Southern India. 1/8/21.
Paul, Bt. Lt.-Col. W. R., C.B.E., D.A.D. of Arty., A2 War Office. 1/10/21.
Rowbotham, Lieut. G. R., Special Employment, Rhine Army. 6/8/21.
Rawlins, Bt.-Col. S. W. H., C.M.G., D.S.O., Comdt. Warfare Experimental Station. 29/8/21.
Sandeman, Lieut. G., Staff Capt. "Q" 5th Divn. 19/9/21.
Scott, Lieut. A. G. O'C., seconded to King's African Rifles. 16/9/21.
Stratton, Lieut. G. L., M.C., G.S.O. 3rd Grade (temp.), India. 1/8/21.
Taylor, Lieut. A. St. L., Staff Lieut. A.G. 10, War Office. 30/7/21.
Thornton, Bt. Major W. H. J., M.C., D.A.Q.M.G., Egypt. 1/9/21.
Wills, Lieut. J. P., M.C., Transportation Service, Rhine. 6/8/21.

Royal Garrison Artillery.

Benfield, Capt. K. V. B., D.S.O., M.C., Staff Capt., H.Q., Malta. 10/8/21.
Davidson, Major C. G. F., D.S.O., M.C., Staff Capt. R.A., Malta. 10/8/21.
Gleeson, Lieut. F., Intelligence Officer, Iraq. 27/9/21.
Harwood, Lieut. A. F., Att. Royal Corps of Signals. 22/8/21.
Kelly, Lieut. C., M.C., M.M., Intelligence duties, Ireland. 1/5/19.
Labouchere-Sparling, Lieut. F. F., M.C., Intelligence Officer, Rhine, with temporary rank of Capt. 10/9/21.
Stephenson, Lieut. W. T., seconded to Tank Corps. 4/9/21.
Turbutt, Capt. R. B., Adjt., Central Gas School. 6/10/21.

Relinquishments.

Martel, Hon. Brig.-Genl. Sir C. P., Kt., C.B., Relinquished Appointment at Ordnance Factories. 1/6/21.
Tancred, Maj.-Genl. T. A., C.B., C.M.G., D.S.O., A.-D.-C., relinquished appointment as Col. Royal Artillery. 17/8/21.

REGIMENTAL LIST. The following Casualties have taken place from 20th September to 15th October, 1921.

First Appointment.

Eliot, W. E. C., to be 2nd Lt. R.H. & R.F.A., from Royal Military College, Kingston. 24/6/21. (With seniority from 24th June, 1920).

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Promotions. (Non-Regimental).

Auley, Lt.-Col. W. B., D.S.O., to be Colonel, 22/9/21, with seniority 1/5/21.
Bowen, Lt.-Col. H. W., C.I.E., D.S.O., to be Colonel, 22/9/21, with seniority 1/1/21.
Grant, Lieut. W. C., M.C., Temp. Capt. while employed with W.A.F.F. 10/6/20.
Hanna, Lt.-Col. J. C., D.S.O., to be Colonel 12/10/21, with seniority 1/5/21.
Heywood, Major T. G. G., O.B.E., to be local Lt.-Col. while specially employed. 22/7/21.
Lawrence-Archer, Lt.-Col. J. H., C.I.E., to be Colonel 22/9/21, with seniority 1/1/21.
Molesworth, Lt.-Col. H. E., C.M.G., D.S.O., to be Colonel 22/9/21, with seniority 1/5/21.
Nuttall, Lt.-Col. C. M., D.S.O., to be Colonel 12/10/21, with seniority 1/5/21.
Palmer, Lt.-Col. C. C., to be Colonel 22/9/21, with seniority 29/11/19.
Rawlins, Bt. Lt.-Col. S. W. H., C.M.G., D.S.O., to be Colonel 29/8/21, with seniority 1/1/19.
Sturrock, Lt.-Col. G. C., to be Colonel 22/9/21, with seniority 1/5/21.
Swinton, Lt.-Col. C. W., C.M.G., D.S.O., to be Colonel 22/9/21, with seniority 1/5/21.
Taylor, Lieut. R. W., temp. Capt. while employed with W.A.F.F. 27/8/20.
Twistleton-Wykeham-Fiennes, Major N. I. E., D.S.O., Temporary Lt.-Col. (T.A.). 8/9/21.

To Half Pay List.

Barker-Benfield, Lieut. T. F., M.C., (temp.), on account of ill health. 23/9/21.
Benett-Stanford, Capt. V., M.C., (temp.), on account of ill health. 15/10/21.
Bower, Lieut. H. R., M.C. 13/10/21.
Cawson, Capt. L. D., (temp), on account of ill health. 19/8/21.
Geddes, Lieut. R. A. H. S., M.C., (temp.), on account of ill health. 13/9/21.
Lovell, Major E. H., (temp.), on account of ill health. 23/9/21.
Meeres, Lieut. C. O., (temp.), on account of ill health. 16/9/21.
Patman, Lieut. B. P., (temp.), on account of ill health. 13/10/21.
Robinson, Lieut. T. H. 19/9/21.
Sharp, Capt. D. C. G., temp. on account of ill health. 5/10/21.
Sharpe, Capt. R. F. H., (temp.), on account of ill health. 16/8/21.
Willis, Lt.-Col. S. G. R., D.S.O. 1/10/21.
Wyatt, Lt.-Col. G. N., D.S.O. 4/10/21.

From Half Pay List.

Barker, Major C. H., R.G.A., restored next above C. J. Everard. 22/9/21.

Transfers.

Wade, Lieut. D. A. L., M.C., Transferred to Royal Corps of Signals. 6/10/21.

Retirements on Retired Pay.

Collins, Lieut. F. C., with rank of Capt. 3/10/21.
Deacon, Lieut. D., M.C. 17/9/21.
Dorrell, Capt. G. T., M.C., with rank of Major. 23/9/21.
Furnivall, Lt.-Col. W., D.S.O., from half-pay list. 24/9/21.
Godsal, Lieut. H., from temp. half-pay list. 24/8/21.
Milman, Major O. R. E., D.S.O., with rank of Lt.-Col. 30/9/21.
Robinson, Lieut. T. H., from half-pay list. 12/10/21.
Rose, Capt. C. E. 18/9/21.
Slade, Lieut. F. R. 13/10/21.
Tovee, Lieut. E. E., M.C., with rank of major. 26/9/21.

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Retirements with a Gratuity.

Brett, Lieut. W. J. 23/9/21.
Broomfield, Lieut. R., from half-pay list, with rank of Major. 10/10/21.
Burges, Capt. W., M.C., with rank of Major. 29/9/21.
Casserly, Lieut. J. A., M.C. 29/9/21.
Jeyes, Lieut. S. R. J. 17/9/21.
Minson, Lieut. A. J., M.C., with rank of Capt. 27/9/21.
Turner, Lieut. A. W., from half-pay list with rank of Capt. 20/9/21.

Resignations.

Ambler, Lieut. K. A., and granted rank of Captain. 11/10/21.
Meyrick-Jones, Lieut. A. S. M. 12/10/21.
Shipton, Lieut. G. F. H. 8/8/21.
Thornes, Lieut. J. N. B., and granted rank of Capt. 5/10/21.
Walker, Lieut. H. S. 29/9/21.

Loss of Seniority.

Andrews, Lieut. P. F., to take rank and precedence as if promotion to Lieut. bore date 15/3/21.
Neve, Capt. R. B., to take rank 3/11/17 next below A. H. Hornby.

Deaths.

Hunter, Lt.-Col. D. H. K. (retired pay), at Kingsbridge, Devon. 17/8/21.
Pegrum, Lieut. L. V., died in West Africa. 2/10/21.
Tailyour, Lt.-Col. G. H. F., died at Millbank. 3/10/21.

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SOME NOTES ON THE FRENCH ARTILLERY.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 25th October, 1921.

BY BRIG.-GENL. W. EVANS, C.M.G., D.S.O.

Colonel D. J. M. Fasson, C.B., C.M.G., in the Chair.

THE CHAIRMAN: The first part of my duty as Chairman, Ladies and Gentlemen, is a "wash out." To introduce General Evans to a Woolwich audience is unnecessary so it only now remains for me to tell him that it is zero hour. (Loud applause).

GENERAL EVANS: Colonel Fasson, Ladies and Gentlemen, I have headed my Lecture "Some Notes on the French Artillery 1921" but I am afraid I am rather a fraud because I have not been really able to find out a very great deal of what is happening in 1921, because I do not think they know themselves quite all the details of their future training. So that what I propose doing is to lead up to the 1921 Artillery by showing how the French propose using the lessons of the great war in their present day artillery training. I shall commence by briefly stating how the artillery developed from 1914 up to the present day.

Before the War the French Regulations fixed as the task of the Artillery the support of the Infantry. In the Offensive it was to take on anything that could check the progress of the Infantry, and in Defence to check the advance and hold up the enemy Infantry.

The disposition of the Artillery was this: The Batteries were in positions of readiness or in action in observation to engage targets when necessary with the least number of guns possible so as to avoid prematurely disclosing their strength in Artillery. It is true that many Artillerymen disagreed with this teaching and thought it would be far more advantageous to commence their battle 3 to 1 on rather than 1 to 2, even although they considered they were far better armed than the enemy was likely to be.

As far as the actual tactics went, the targets seen would usually be scattered and behind cover, or shields in the case of the Artillery, and would not justify a very large expenditure of ammunition. As for unseen targets, they could only be taken on by short series fired at areas. Observation from the air was in its infancy, and its possibilities not much reckoned on, so that although destruction of material was recognised when possible, yet the general procedure was the firing of a comparatively small number of rounds at targets of opportunity.

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Those responsible for the Regulations were greatly influenced by the fact that only 1200 to 1300 rounds of ammunition per gun existed. The French High Command had not realised what machine gun fire was to mean, and, in short, Artillery was to support an attack but not to prepare it.

As for heavy artillery it was practicaly non-existent although its characteristics were just touched on in the Regulations. Each Division —a Division consisted of 12 battalions of Infantry—had only three groups of 75's and the C.R.A. was not at all the important Commander he afterwards became. To sum up, when the French mobilised, they looked forward to using their 75's almost entirely with no very great expenditure of ammunition. Hardly any heavy Field Artillery existed as its importance was not recognised, or perhaps the powers that be did not wish to recognise it on the ground of expense. 3,840 75's were available at the commencement of the War with 1,300 rounds per gun; 308 heavy artillery mobile guns existed of which 104 were quick-firing guns but only of moderate range. That was the situation at the commencement of the war.

In 1914 the French Infantry attacked with great gallantry and in massed formations without artillery preparation. The result was heavy losses mainly from machine gun fire, so that the Infantry tactics had very quickly to be modified. The German procedure of starting their attack with considerable doses of "black marias" or "Jack Johnsons" or "marmites" as the French called them, fired from very long ranges, brought out the importance of the effects of Heavy High Explosive shell fired at long ranges. The first result of this was that in November 1914 a group of Heavy Artillery was allotted to each Army Corps. The French 75's did very good work it is true in Lorraine and on the Marne mainly when the French counter-attacked. Their success was principally due to the fact that in counter-attack the targets were near enough to be engaged with ground observation. In some cases good results were got by aeroplanes spotting nests of batteries at shortish ranges and firing area shoots at them; but both in supporting the counter-attacks and in these area shoots much more ammunition had to be expended than was foreseen, and the ammunition supply ran short in a very few weeks. However, the lesson was learned and artillery was recognised as the great factor in modern war.

Now we come to the period of trench warfare, and trench warfare was brought about by shortage of ammunition. By the grace of God the Germans, who had had the foresight to produce 6,000 Heavy guns with which to start the War had not produced enough ammunition to feed them. Now the French, and ourselves for the matter of that, not only had to produce ammunition but had to create Heavy Artillery.

The French were lucky in having a very large number of de Bange's guns in their forts, and they dismounted these and brought them into the field, and wonderful service they did too. People like myself who are retired, and who were cadets about 1890 or even earlier, remember the de Bange obturator you are all familiar with so you can guess the

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age of these guns. Colonel de Bange, who was the inventor of these guns, died in August 1914, so that he just missed seeing the great work his old guns were to do.

The first orders for new guns were given to Creusot for guns of 10·5 cms., that is about 4·2. Towards the end of 1914 the manufacture of Trench Mortars was commenced. These weapons were very quickly produced and they provided a partial remedy for the shortage of Heavy Artillery.

I do not propose following step by step the development of material and methods all through the war, but briefly they were,—in 1915 the methodical preparation of an attack was studied; in the Autumn of 1915 aerial observation became general and ground observation for Heavy Artillery was helped by survey sections, sound ranging sections, etc. The Command of Heavy Artillery was organised and to a certain extent schools of instruction were started at Chalons, Toul and Amiens, and the lessons of the attacks of September were gone into, and methods improved. The necessity for a very much closer liaison between Infantry and Artillery was recognised, and liaison detachments were created. Counter-battery work also commenced, with much discussion as to its value. These were the days of more or less standing defensive barrages.

Then the next big event was the Battle of Verdun, and counter preparation came into being. I do not know that it is necessary to explain what counter preparation was; I expect that everybody here, certainly everyone who has been to the War, knows all about it. It was a great advance on the purely defensive barrage as it broke up and disorganised attacks with considerable losses to the enemy. Meanwhile the counter-battery work proved itself to be a success in the minds of the French Artillerymen. Slow barrages, fire in retaliation, and that sort of thing, were practicaly dropped.

The great feature of the Artillery programme for 1916 was the constitution of a general Reserve of Artillery under the Commander-in-Chief. This general reserve of Artillery was used afterwards by being allotted either to groups of Armies or to Armies who, in their turn, allocated the guns when necessary to a Corps either in a big attack or to prevent a German Offensive succeeding. (I am not quite clear as to when the idea of what the French called the "75 porté" started, but the 75 porté was that the French put a 75 gun with 200 rounds of ammunition into a lorry and they pushed it off to whatever front was desired, so you see they had great strategical mobility but very little tactical mobility. When it was necessary to push them into action in positions far from roads, then it was up to the Divisions in the line to find teams to pull their guns into action.) During that year extra guns were posted to Infantry Divisions and to Army Corps.

Now we come to the Battles of the Somme, and by that time the manufacture of guns and ammunition had proceeded fairly well, so that we find that on the Somme an attacking Division had an average of six groups of 75's (a group, as I have put on the board there, consisting of three 4-gun batteries) and from six to eight batteries of heavy howitzers.

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They were under the Colonel or Lieutenant-Colonel who commanded the Divisional Artillery Regiment. The Corps had at their disposal 18 to 25 batteries, all these under the Lieut.-Colonel commanding the two groups of heavy guns belonging to the Corps. This rather brought out the shortcomings of the method of Command in the Artillery, and I believe I am right in saying that the French General Staff were rather like our own—they had the greatest aversion to making high Artillery Commanders; they liked advisers but they did not like Commanders so much. I do not know if I am very discreet in saying that.

The attacks of 1916 and 1917 were all preceded by long Artillery bombardments and entirely lacked the element of surprise. Then came a tremendous change. In September 1917 the German General Von Hutier completely overwhelmed the Russian positions at Riga, thanks to surprise, by the intensive use of gas shell. In November 1917 General Byng by employing 360 Tanks, which were brought out under cover of fog, attacked and broke through the German front to a depth of 9 kilometres with no artillery preparation at all. These two operations led up to the tactics that won our battles in 1918.

The great improvements in methods of fire, the greater understanding of the effects of temperature, atmospheric conditions, etc., made it possible to put batteries into action in carefully surveyed positions by night without disclosing their position at all until the actual moment of attack. I shall not go into the details of the policy for early 1918, but I would say that as the German Offensive was expected, and it was thought it would commence on somewhat similar lines to the attack at Riga, the artillery dispositions in defence were considerably altered. The defence in depth was accepted, and that remains the accepted principle now for the employment of Artillery in Defence.

To review shortly the 1918 Offensive Battles, all the Instructions issued by the High Command towards the end of 1917 emphasised the advantages to be gained by surprise. The following conditions had by this time come about to facilitate its attainment. Firstly the French tanks were ready so that the wire need not be cut by artillery previous to attack. Secondly, a great number of mobile heavy batteries were available capable of being transported rapidly to any Front and got into action quickly. Thirdly, with such a number of guns the artillery preparation, that formerly was a matter of days, could now be fired in a few hours. Fourthly, ammunition was at last plentiful and neutralisation by gas shell could be undertaken to facilitate the work of the Artillery. Colonel Maitre, the French Divisional Artillery Commander attached to the Americans during the War, and from whom I have borrowed very largely in the foregoing, adds another condition and that was that the Boche was not quite so good in 1918 as he had been from 1914 to 1917; and he points out that this question of morale must be taken into consideration—as he says, "lest we fall into costly errors in the future."

In the above conditions Artillery action in the Offensive consists in very short violent Artillery preparation; during the attack neutralisation of the Infantry and hostile batteries, blinding O.P's etc.;

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destruction of counter-attacks and denial to the enemy of points of assembly and approaches for his reserves and supplies. In the exploitation—rapid moves forward of the guns; decentralisation of Command until further organised resistance demands again concentration of the artillery. In the Defence—Artillery organised in depth, concealment of batteries, (silent positions, camouflage, etc.) and guns in reserve ready to put into action where necessary.

This then was the state of advancement to which artillery teaching had reached when the war ended. In material from having 308 heavies in 1914, at the Armistice the French had 4,600 heavy guns, 3,300 of which are modern; they had 340 A.L.G.P.[1] guns, and they had 2,000 Trench Mortars, so that ample means were at the disposal of the High Command to carry out any task demanded from the Artillery. The High Command had learned at last the part Artillery had played in modern war, and they are now determined that for the future the Artillery in Peace time shall work with the other Arms, and that as far as possible Units shall be under the command of the Generals who will command them in War. Of course Armies, Groups of Armies, and Army Corps cannot be kept up in Peace time but the Divisions can and will be, and the Division will participate in the Instruction of large Units of Artillery.

My next point is rather an elementary one, that is how the French Artillery is sub-divided and the natures of gun and howitzer belonging to these sub-divisions and their tasks. The French Artillery is divided into Light Artillery and Heavy Artillery. Light Artillery consists of guns of small calibre, 75's mainly, range up to 10,000 yards, great tactical mobility when horse drawn and great strategical mobility on lorries or by rail. Their task is the direct support of Infantry by engaging personnel, tanks, counter battery against guns in the open, what the French call "feu d'interdiction" (denying fire) harassing fire, masking by smoke shell, and neutralisation by the use of gas shell.

The Light Artillery is split up into horse artillery, which work as ours do with Cavalry Divisions, armed with 75's; "mounted" artillery armed with 75's belonging to the Infantry Divisions; mountain artillery, and their fourth sub-division is the "Artillerie Porté" which is what I told you of, batteries of 75's mounted on lorries which belong to the general reserve of artillery, corresponding to our Army Brigades in the late War.

The Heavy Artillery is divided into two sub-divisions. "Artillerie Lourde Courte," consisting in howitzers of medium range and medium or great power, fairly mobile when horse drawn and with great strategical mobility when tractor drawn or by rail. They consist mainly of howitzers from 15·5 to 22cms., that is roughly 6-inches up to eight. Their tasks too are to engage personnel, to support Infantry attacks or attacks on troops concealed or in trenches. The "Artillerie Lourde Longue" consists of the long guns of the Heavy Artillery, flat trajectory guns of high velocity and varying calibres—105, 145, 155 and 194 mms. The 105 is rather a remarkable gun because it is

[1] Artillerie lourde à grande puissance.

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very mobile; it looks rather like a big 75 and it is particularly useful for harassing fire "feu d'interdiction" and for attacking fleeting targets. Its mobility is equal to that of the field artillery and it has a range of 12,400 metres and can fire six rounds a minute.

Another rather remarkable gun is the 155 G.P.F. which has a range of 18,600 metres, its split trail allowing for 60 degrees traverse so that it is a very good weapon for engaging fleeting targets or quick concentrations of fire.

The 145/155, which simply means that the gun starts life as 145 and, when it wears, it is bored out again and becomes 155, has a range of 18,500 metres but is not suitable for targets which require frequent or quick changes in direction. There is another gun, the 155 long Schneider 1917 pattern, much the same as the last one, only with rather a shorter range.

Trench mortars are now called the "Light Powerful Artillery." The French prefer to call them by that name and there is very little remarkable about them except that certain people say that, carried on heavy tanks, they might be used as guns of accompaniment.

Then there is the other part of the Heavy Artillery, which they call the A.L.G.P. (Heavy guns of great power) which comprise various long range guns capable of firing big shell. Its tasks are counter-battery (in certain special cases) the engagement of distant targets, "feu d'interdiction" and the destruction of ammunition stores and all those targets which our own Army Artillery would take on.

Tactically the artillery is organised as follows: Divisional Artillery consisting of 75's and 15·5 Howitzers; Corps Artillery mainly guns not Howitzers, and the general Reserve of Artillery under the Commander-in-Chief. The Division and Corps have Light and Heavy Artillery belonging to them, and unlike us the French Division in War had a Regiment of Heavy Artillery not attached or affiliated but part and parcel of the Division. In Peace time each of the 34 Divisions, which I believe is to be the strength of the French Army, will have one group. There has been considerable argument as to whether the Heavy Artillery should not be transferred to the Corps, and I have noticed in the "*Revue d'Artillerie*" various articles on the subject. Gén. Farsac is very anxious to transfer all the Heavies to the Corps, because he says in a Battle the Corps is the tactical unit. Personally, during the War, I always wished that we had had the French arrangement, that it, that we had had our own percentage of Heavy Guns belonging to us, instead of being allotted to us when the Corps thought fit.

I have led up at some length to the procedure during the later stages of the Great War, because it is on the Battles of 1918 that the teaching of the "Provisional Instructions for the use of Artillery in the Field" is based. In the United States Field Artillery Journal an article says: "The French Artillerymen believe that the basic instruction should be on the principles used at the end of the War, and that instruction in the rapid preparation of fire for open warfare will then be a simple process, after the more difficult and technical details of the

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preparation of fire, using carefully prepared maps and all other data employed during the last years of the War, have been mastered. As a matter of fact the new Firing Regulations (1920) devote ample space to a discussion of rapid preparation of fire, which would be the only method available under certain circumstances." The Editor adds a footnote of his own: "The French must first anticipate position warfare, for it should be borne in mind that their tactical and strategic plan of campaign is necessarily based upon their geographical position and frontier system of defence, which, organised as it is upon a chain of strong points, will sooner or later bring about stabilisation."

Although it is hard to prophesy what the next war will be like, especially nowadays when Science advances so rapidly, yet one can foresee that superiority in material will be more than ever necessary, and that unless a very long time elapses before the outbreak of another war all of us will be using the same guns as were in use in 1918, for the very simple reason that none of the Powers have enough money to replace them with more modern ones. In the introduction to the text book I have just mentioned, we find accepted as doctrine, firstly, the phase of preparation except in exceptional circumstances, when it may be reduced in duration or even dispensed with if the attacker wishes to avail himself of the advantage of surprise and is certain of superiority in fire at the moment of assault. Secondly, the rolling barrage which according to the book is a "dense and deep curtain of fire moving in front of the attackers and stopping in front of them when they stop. It may consist in some circumstances of heavy concentrations on the various points forming the nuclei of the enemy's resistance." According to Marshal Foch we may expect in future fighting "Sometimes on positions, sometimes between positions, sometimes *even* in the open," so that we see that the French teaching of the present day is to a certain extent, perhaps I may say largely, that of position warfare.

Up to this point my Lecture has been more or less consecutive, but time does not admit of my doing more now than read a few notes. Some of these may be incorrect or out of date. The Divisional Artillery seems likely to remain horsed for the present. The question of the gun of accompaniment is not solved. You all know what I mean by the gun of accompaniment; it is the gun you push right forward with the Infantry as soon as they go forward. Certain of the French Artillery Officers told me that the idea of the Artillery is that this gun should belong to the Infantry, the reason being that they find that a gun like our own 18-pounder or the 75, a high velocity gun, is not a suitable gun for shooting at very short ranges, whereas a little gun carried on a light tank, would fulfil the object more successfully. A light agricultural tractor is being produced in France, mobile on or off the roads, to fulfil military requirements. It is possible that the gun of accompaniment may be a 75 drawn by one of these, and even possible that gun and tractor may be both loaded on a lorry to gain strategical mobility.

The general reserve of Artillery is recognised as the only factor which makes it possible for the High Command to fight simultaneous battles, or lessen the delay between successive battles. This is the

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tail end of another of Marshal Foch's Orders—in a circular Order after the German attack of July 12th, 1918: "It is better to attack definite points and intensify the interdiction, the counter-battery or the crushing fire on definite points, reserving a part of the field batteries to accompany the Infantry in intimate collaboration with it"; so that points to the fact that he valued the gun of accompaniment.

Now for a few notes on personnel. At the end of the war all the officers who were Captains at the commencement were Lieut.-Colonels and practically the whole of the Subalterns were Commissioned during the war and mostly had temporary Commissions. Normally Officers are educated at the Ecole Polytechnique for two years and pass as Second Lieutenants to the Artillery School at Fontainbleau[1] where they undergo an eleven months course before being posted to a Unit.

Another source of officers in the French Army is Non-Commissioned Officer "Aspirants," as they call them. The N.C.O. who has passed a special examination goes to the Artillery School at Fontainebleau, not the same School that the Polytechnique Officers go to but another School,[2] and they are commissioned when they leave that School after a year's course.

In 1920 out of 457 pupils at the Ecole Polytechnique only 25 elected to become Artillery Officers, so that you see Artillery Regiments in France now mainly consist of a Colonel from the Ecole and the other officers promoted from the ranks, or temporarily commissioned. It is true that the latter have all war experience, so that a high standard can be maintained for the present, but later on, as the methods of fire become daily more scientific, it is obvious that something has got to be done to produce officers highly educated in Mathematics and Science. An article in the "*Revue d'Artillerie*" last August deals with the causes of what it calls the "Crisis in recruiting officers for the Artillery," and it suggests certain remedies. Some of the causes are rather interesting. One is that gunners did not like their uniform being tinkered with. The gunners and the cavalry used to wear a dolman—I suppose you all know what that is—and that was done away with for the artillery and they even took nine buttons off the jacket and put seven on, the same as the infantryman. When the artillery increased, they started some new camps rather like Bulford, and the camp at Chalons came into being, and places like Versailles were done away with as Centres of Artillery; in a word the status and privileges of the Regiment, or rather of the Arm, were lessened, with the result that many Polytechnicians who would have become Gunners preferred to go into civil life.

As to N.C.O's—I think this will be of interest to some of you N.C.O's—service in the Army is now for two years, so that it is obvious that although an N.C.O. may even become a "chef de pièce" which means No. 1, you cannot expect much of him as an instructor or a specialist; so that men are asked to engage for three, four or five years

[1] Ecole d'application d'Artillerie.
[2] Ecole d'Artillerie.

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or to re-engage, and this was already a matter of difficulty before the war. You see the standard of living had become higher but the pay remained the same as it always was. In the old days of the French Artillery 20 years ago the N.C.O's. were professional soldiers so that there was not the slightest difficulty in getting Equitation Instructors and all those sort of people.

Many of you may not be aware of the fact that in the French Battery there are only two Subalterns. The No. 1, the "chef de pièce," therefore has a much larger responsibility than with us and he was practically a Subaltern Officer. During the war specially trained N.C.O's. usually undertook the duties of our F.O.O. In a 75 Battery, of the two Subalterns in the later stages of the war one was usually a Regular, and he was called the "Lieutenant de tir," which means the Shooting Lieutenant and his job was to be in the Battery while the Battery Commander was at the O.P., (the O.P. not being the Forward Trench necessarily; that would be where the N.C.O., F.O.O. would be).

Then how do you get the N.C.O's.? As soon as a man comes into the Regiment, he is asked if he would like to be an N.C.O. He is put into a class in the Group, the group being equivalent to our Brigade as you know, where he is taught to be a young N.C.O. There is another class in the Regiment which teaches young N.C.O's. the duties of higher ranks.

Roughly the pay in the French Army is this : The "Adjudant" who corresponds to our Warrant Officer, gets 430 francs a month, the Sergeant gets nearly 400 and the Corporal 150. Taking the franc at 50 to our pound, the Corporal gets about £3 a month. The Private still only gets 2½d. a day, but then that does not matter because he has got to be a Private whether he likes it or not.

Now as to the rank and file. As you all know every one in every foreign country has a duty he has to undertake once in his life for a very short time, that is, he has to serve his country in the army and when the "Conscrits"—are medically examined, the men are asked which arm they would like to join. They are not necessarily posted to it but if suitable they are. If they enlist for a period of over two years, they have their right to choose. Artillery recruits are selected from amongst peasants with some knowledge of horses, whom they turn into drivers, or workman such as fitters, turners, etc., who become gunners and who, as a rule, very quickly become fit to be "chefs de pièce."

As you know there is a ballot for youngsters who have to serve in the Army, and anyone who likes to volunteer for service six months before he comes up for the ballot is allowed to choose the Arm of Service he wishes to serve in. Some years ago Hilaire Belloc gave a Lecture here which he called "Barrack Life in the French Army." Many of you perhaps may not know that he served a year as driver in the French Artillery and he described the training and, as he was only up for a year, you can imagine that he had to go through it a bit more than our long service soldiers have. The whole of his training had got to be crammed into a very short time.

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Now I am going to give you a few notes about the Schools. At Metz is what they call the Centre d'Etudes Tactiques d'Artillerie (the Central School of Artillery Tactics). The Staff of that School consists of Gunners with one Infantryman and one Airman. In that School Generals, Colonels, and Majors of all Arms are instructed in the use of Artillery and they undergo a two month's course. Captains go through a Battery Commanders Course of five weeks at Bitche for horse drawn artillery, or Mailly for Automobile Artillery. Majors and Lieutenants-Colonels go through a Theoretical Senior Officers Course for a fortnight at Versailles followed by attachment to a Division at Mailly. There is is also a three week's Course in Gunnery at Mailly under the Commandant of the Practice Camp. I will not go into the other special courses such as tanks, etc. They are very much the same as our own.

I do not like to close without saying how tremendously I personally, and I expect all of us, admire the French Artillery, and it is very noticeable in the German Stories of the War the dread in which they held it. Whenever I encountered the French Artillery during the War, although perhaps their sanitation was sometimes a little careless, everything connected with their shooting I found to be absolutely splendid.

That is all I have to say, Sir.

THE CHAIRMAN: Would anybody like to ask the Lecturer a question? I am sure he would be very pleased if you would.

CAPT. GRANSDEN: If I may say so there is one point you brought out with regard to the strategical use of the Light Field gun which was taken about on lorries. As a junior officer I never saw anything of the French Artillery during the War; I merely saw our own. Our own 18-pounders were brought back to workshops in lorries and I do not know that they were used in quite the same manner as you have told us of the French Artillery, but I think a good many people will agree that the importance, which I think you have brought out, of Heavy Artillery as compared with Light Artillery has undoubtedly increased as the result of this War, and perhaps it is not too much to say that it will proportionately increase in the future.

Now the point I wish to ask you, Sir, is, do you think the French fully appreciate increasing the strategical and the tactical mobility of the medium heavy artillery for the future? In asking you this, I observed in our own artillery during the war that we had neither strategical nor tactical mobility for these reasons—that structurally our medium Heavy Artillery was unsuited to strategical movements by road. As regards their tactical mobility in the fighting advance a good deal, from my own observation, depended on the personal character of the Group Commander, as to how he forced his guns forward against natural obstacles and, of course, it is not scientific to rely on the personal factor!

GENL. EVANS: Well, that is rather a big question and it would take me another hour or so to answer it I think. So far as I can gather the general Reserve of Artillery is to be highly mobile, strategically and tactically; I told you that I believed the Divisional Artillery was

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to be horse drawn, and the reason for that is that in the sort of warfare I have told you that Americans and others think the French are going to commence with in the next War, that is a position War of sorts, the Divisional Artillery will not be called on for rapid strategical moves. The general Reserve of Artillery will be the factor which is going to win their battles against whoever the next enemy may be, or help them to win the big battles quickly. That is a matter of very great consideration with them I believe.

I am awfully glad you said what you did about the personal character of the Group Commander, because it enables me to say that I strongly advocate having heavies *belonging* to the Division.

I felt that if the Divisional Commander wanted a quickly organised shoot by 6″ Hows. it was a most excellent thing if he knew the Heavy Artillery Colonel well.

You had the feeling then "Its Colonel So and So and our own heavies doing it, so all will be well."

Colonel some one Else affiliated from the corps might have been equally efficient, but the question of liaison came in, and it was impossible to expect battalion commanders and others to have the same faith in him that they would have had in their own man.

You said that we had nothing strategically or tactically mobile and of course you were referring to the medium artillery. Our Army Brigades had 4·5 Howitzers, really you might almost call them medium artillery, and I used to think it was extravagant that they should be not only horsed but that they should have Brigade Ammunition Columns belonging to them, and would have preferred them to resemble the 75 Porté. Tactically they were far more mobile than anything else.

I do not think I need say very much more. I expect Colonel Fasson really knows far more about that than I do as he had a Corps.

THE CHAIRMAN: I only want to ask one question and that is do you know how long the shortage went on in the French Army at the beginning of the War? Was it anything like so serious as ours?

GENL. EVANS: The shortage of ammunition?

THE CHAIRMAN: Yes.

GENL. EVANS: I imagine so for a time. I think one thing was that when they had to go in for very high production of ammunition it was not reliable; they lost a lot of guns blown up when they started making their new ammunition, and I suppose the shortage was a great deal due to that—that the first lot of ammunition when they began to produce it in mass was very unsatisfactory. Colonel Maitre says in 1918, that AT LAST the ammunition position was satisfactory, so I conclude that they had been in a bad way.

THE CHAIRMAN: General Evans tried to draw me just now but this is his Lecture, not mine. I should just like to mention one thing which struck me about the French Artillery, in addition to the many important points General Evans has referred to, that is their excellent feeding arrangements. I had to reconnoitre one day a portion of the

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line occupied by the French which we were going to take over, and the Artillery Commander made a programme for me the first day according to which I was to have dejeuner at half-past 12 at a Group Headquarters. I was conducted there at half-past 12 and it was a very tiny dug-out; we were crammed, I do not know how many but about 12 of us altogether into it, we could just sit down, but the meal they gave us—well, the Ritz or the Mess on guests night were not in at all. I cannot tell you how many courses and there was a different wine with every course; it was very pleasant but it took a very long time, and as I had not much time at my disposal the next day, I had to say that I would take my sandwiches with me, otherwise—(Loud laughter).

I would like to back General Evans up about having heavies in a Division; I am altogether a whole hogger for it. Now I am sure you will all wish to thank him very much indeed for his excellent Lecture which he has evidently taken a tremendous amount of trouble over. Will you show your appreciation in the usual way? (Loud and continued applause).

GENL. EVANS: Thank you very much, Sir, and thank you gentlemen.

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TENDENCIES OF MODERN ARTILLERY.

BY THE LATE MAJOR-GENL. C. E. D. BUDWORTH,
C.B., C.M.G., M.V.O.

THE following notes were found among the papers of the late Major-General Budworth. He had apparently intended at some time to work them up into an article :—

The tendencies of modern artillery are difficult to appreciate by what we see actually taking place around us, for development practically ceased with the war. This is due partly to the universal wish to end war and partly to lack of financial support which blocks the way to the provision of the engines of modern war.

To appreciate the tendencies of modern artillery we had best ask ourselves what developments would there be, supposing we had seriously to prepare for a great war within, let us say, two years.

It is well to fix a limit in time, as that may serve to prevent us from making excursions into the realms of fancy.

It is unnecessary to dilate on the part played by artillery in the great war, but I cannot resist mentioning that H.E. the Commander-in-Chief in India as an Army Commander in France, had at one period under his command nearly as many men engaged in artillery duties as he has troops under his command in the whole of India to-day, that these men were armed with nine times as many guns as his armies in India now possess and that he was responsible, not only for breaking the Hindenberg line and crossing the canal north of St. Quentin, but for firing more rounds of artillery ammunition in doing so in 36 hours than he could produce in India to-day for a great war.

At the end of the great war, was there any symptom of a decline in the value to be attached to artillery in war? If so, it would appear to have been well camouflaged.

The rise of importance in other arms such as R.A.F., Tanks, Machine Guns and developments in mechanical transport, signalling etc., affect the artillery very much, but they do not lessen its value.

It at once becomes a question from an Artillery point of view of how these factors can best be used as friends or abused as foes.

The main rôle of the artillery in relation to infantry or cavalry remains just the same as it was 100 years ago and for its fulfilment it has to make use of every fresh development in science and skill.

It is proposed to deal briefly with the tendencies of artillery in relation to :—

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1. *The action and re-action* caused by development in the other arms and branches of the service.
2. Guns and ammunition.
3. The general tactical aspect.

1. (a). *The R.A.F.*

The tendency of the whole war was towards closer co-operation between R.A.F. and Artillery in the direction of artillery fire.

Are we to go back on this in the future? Assuredly not.

In the next great war, the army which has already become skilled in co-operation between R.A.F. and Artillery, i.e., the location and indication of artillery targets and their effective engagement by fire direction from the air, will possess a pronounced advantage.

The means towards this end, are, or should be available. What is required is to put them into practice.

The action of hostile aeroplanes is bound to enforce still more the necessity for concealment whether in action or on the move and for protection on the part of the artillery.

How will it be possible for vast masses of horses to exist?

If ever there was a time when we may be said to have had command of the air, it was after the battle of Amiens. Yet immediately after that battle, we lost over 200 horses in one Artillery Brigade, from three bombs. This cause alone will be sufficient to prohibit large concentrations of horse-drawn artillery vehicles in future wars.

The war left us at a stage where we were developing a great system of co-operation between R.A.F. Anti-aircraft guns and Search Lights.

Guns and Search-lights were being organised in broad belts along the front, which it was necessary for hostile planes to penetrate. Behind these belts, railheads, ammunition dumps and localities, important for one reason or another, had to be defended by anti-aircraft guns.

In fact A.A. Defence by guns and no less by searchlights was rapidly becoming a huge organization and this organization had to be made applicable not only to stationary but to moving warfare.

Such an organization is bound to assume a very great importance in the future.

(b). *Tanks.*

As foes, artillery has no reason to dread tanks; but even as foes and certainly as friends tanks are likely to exercise a very great influence on artillery equipment.

Firstly, the desire to make record shooting bags against tanks will lead artillery to adopt generaly the open trail system, such as we have at present in our Pack Artillery howitzer equipment, a system which is no new one and which might have been adopted with advantage years ago.

Secondly, artillery may quite likely adopt the tank means of progression as its own.

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(c). *Mechanical Traction.*

It really is a remarkable fact that our artillery at the end of this great war, is so far as mechanical traction is concerned, very much in the same state as it was before a shot was fired.

We still have these enormous ammunition columns, with their mass of horses and harness. Well, they will not live long in the next great war; the R.A.F. will see to that.

It may be asked if my proposal is to abolish horses altogether. The answer is no, not to-day. But I do definitely recommend that horses should now be confined to the firing battery and that every thing behind this should be mechanical traction. That is at any rate a clear dividing line and a definite recommendation. What about the required material, lorries, tractors, tanks, etc.? Can satisfactory material be produced? Of course it can. It is unnecessary to debate the question.

What about personnel? This brings me to my next point.

(d). *The training of artillery personnel.*

Do we recognize to-day that the artillery service is undergoing a great change?

That guns, ammunition and means of traction or transport are all becoming much more technical?

We may do so in theory, there is not too much sign of it in practice.

The time has arrived when an artillery officer's education must be modified.

He will have to go not only through the "Shop" but the engineers shops and receive a far more practical education in equipment and ammunition.

The rank and file in their turn will not only have to be trained as layers and fuze setters but as mechanics and fitters.

Artillery will have to be capable of looking after their own equipment and ammunition, and the lamentable anomaly of their guns being driven into action by another branch of the service, which exists to-day in the Medium Artillery, will have to be swept away.

(2). *Guns and Ammunition.*

The same general categories are required now as in the past, i.e. Pack, Field, Medium, Heavy and Super-heavy.

The relative values of gun and howitzer have more or less found their level.

The struggle to develop the two great factors range and accuracy must continue and they have to be combined in varying degrees, depending on the equipment in question weight of shell, muzzle velocity, rapidity of fire, mobility, etc.

The value of accuracy in guns need not be insisted on; and, as regards range, the fact that every big war sees an increase in the range at which guns are employed speaks for itself.

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It is not the actual number of casualties caused by long range fire which counts, but it is the fact that an increase in range of guns forces back headquarters, railheads, ammunition, dumps, hospitals, rest camps, etc., and creates a general feeling of insecurity calling for all sorts of measures to guard against unfortunate accidents.

For the definite purpose of shelling important centres, it may be well worth while to construct guns of super-range as was done by the Germans in the case of Paris.

It is an expensive business, however, as the life of such guns is bound to be short.

It is probable that the Germans employed against Paris 7 guns in succession to fire 303 rounds, killing 256 people and wounding 620.

The 50% length and breadth zones have been calculated at about 2 miles and $\frac{3}{4}$ mile respectively.

These statistics are derived from an article by Lt.-Col. H. W. Millen of the Ordnance Department, U.S.A.

Even in Indian frontier fighting the factor of range is liable to be one of importance.

I propose now to take over equipments as employed in the late war, the characteristics of which are public property, as standards.

Our Pack Howitzer is a satisfactory weapon, subject to its limited range of approximately—6,000 yards.

Our Pack Gun is a nondescript article which satisfies few, if any, of the requisite qualifications of a gun.

I do not think that in the future we should be well advised to provide a special artillery equipment for use with cavalry although we might advisedly render our field equipment specially mobile for the purpose.

I am of opinion that howitzers are just as important to cavalry operations as they are to infantry fighting.

In the immediate future there is no reason to compel us to abandon our 18-pr. equipment, but it should have an open trail, rendering it suitable for dealing with quickly moving objects such as tanks and with facilities for firing at long ranges. It should be carried normally on and be capable of being fired from, a mechanical vehicle, from which it can be rapidly dismounted. If this mechanical vehicle, which should carry the detachment and ammunition, can take to the water, swim and climb out the other side, so much the better.

Very similar remarks refer to our field howitzer, though here I think that we might reasonably expect to obtain better value in range and weight of shell for our weight of equipment.

As regards our Medium artillery, 60-pr. guns and 6″ Howitzers are satisfactory standard equipments which require improvements in accuracy and range, both of which are probably more matters of ammunition than gun or carriage.

There is no reason to maintain both 8 and 9·2 equipments. Their respective good points should be combined in one equipment.

Our 6″ gun cannot in my opinion be considered a satisfactory equipment. It is sadly defective in range and its accuracy leaves much

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to be desired, the latter fact being probably due to defects in ammunition. I do not consider that we obtain the same relative value as the Germans do from their corresponding equipment.

Our 12 How. equipment, possibly our best production, is the heaviest we are required to take into the field for normal purposes.

Super-heavy howitzers and super-heavy guns on railway mountings are required for specific purposes. I will not deal with these in detail, beyond saying that it behoves us to pay due attention to the methods pursued by the Germans in obtaining high elevations, and thereby increased range, for their railway guns and the attention and care devoted by them to details of ammunition employed, thereby obtaining increased accuracy.

The necessity for increased range and with it the necessity for accuracy impels us to pay the closest attention to our ammunition in every respect, including the workmanship and finish of shells, fuzes and everything connected with them.

The long ranges at which firing now takes place, combined with the necessity for accuracy, is one of the factors which is increasing the value of H.E. at the expense of Shrapnel Shell.

Shrapnel Shell to be effective requires to be well pitched; over medium ranges one cannot count on so pitching them.

They still retain their relative value over H.E. against troops in the open at favourable ranges, for enfilade fire and for barrage purposes on soft ground, but we have reached a stage where it has at any rate become a question, whether weighing up the advantages and disadvantages both with regard to training and to the carrying of different kinds of ammunition in the field, we should not abandon Shrapnel altogether.

Personally I regard Shrapnel to-day as being very much in the same position as Case Shot was when I joined the service.

The Case Shot was a superior projectile to Shrapnel against troops in the open up to a certain range—to-day Shrapnel is similarly superior to H.E.

If to-morrow all Shrapnel were withdrawn from the service, the advantages gained would be big and the disadvantages incurred comparatively small subject to the provision of arrangements to ensure with H.E. Shells when required :

1. Good ricochet effect at short and medium ranges.
2. Explosion above and not below ground.
3. Explosion in the air (i.e. time fuze) for ranging purposes.

Sooner or later our hands will be forced, as at present we have to deal in addition to Shrapnel and H.E., with Smoke and Gas Shells and at times with Incendiary and Star Shells.

The value of smoke shells has been proved and is capable of further development.

I have no reason to suppose that the late war saw the culminating point in the horrors of gas warfare generally or gas shells in particular.

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(3). *The tactical aspect.*

Artillery action on a large scale to-day involves :—

(a). Getting the artillery into position with all its ammunition with secrecy and celerity.

(b). Locating and then destroying the enemy personnel and material.

The concentration and placing in action of a large force of artillery with secrecy and rapidity involves to-day mechanical means of traction not necessarily to the exclusion of the horse, but its reduction to a comparatively low figure. I will not labour this point, but merely add that whatever form of mechanical transport or traction is employed, we must not overlook the importance of being able to concentrate our artillery at one locality and transfer it rapidly if required to another.

The location of artillery objectives.

Under normal circumstances no attack has a chance of success unless adequately supported by artillery fire, and a necessary antecedent to this is the location of the artillery objectives.

Hence the necessity in war for the development of a great service of artillery intelligence, deriving its information from aeroplane reconnaissance, balloon observation, sound ranging and flash spotting sections, constant observation along the front and from all the channels of the General Staff.

On this information the action of the artillery, whether it partake of preliminary bombardment or sudden development of fire has to be based.

Some areas may be masked with smoke others drenched with gas. The whole tendency is towards a more scientific direction of artillery fire in accordance with carefully collated information and a thorough knowledge of the exact value of the ammunition and guns at our disposal.

No artillery plan of action however scientifically worked out can afford to disregard the value to be derived from those two great factors in artillery fire, i.e., the demoralising effect of enfilade fire and the overwhelming effect of a concentration of fire.

During the process of a battle and in open fighting generally, location of the target remains the artilleryman's great difficulty.

Any target, given reasonable means can be destroyed or negatived provided it can be located; particularly is this the case with machine guns.

Hence the importance of a simple and effective means of indicating objectives from the air, of forward observing officers, of wireless telephonic communication and of a close understanding between infantry and guns.

To these means we must look for enabling our infantry or tanks to progress in open fighting, rather than to barrages which are excellent for a set piece, but take time to evolve, demand many guns and are prohibitive under some circumstances in ammunition expenditure.

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The value of being able to develop a heavy and accurate artillery fire without indicating the intention to do so by previous registration need not be insisted on. This is not to be achieved however by merely issuing orders, it demands a very high standard of training and the provision of equipment and ammunition in every respect facilitating accuracy of fire.

It involves also some knowledge of survey work on the part of the artillery.

I think that it is evident that the whole tendency of modern war is to demand a higher standard of technical training on the part of our artillery, a higher standard in our equipment and ammunition and a greater technical knowledge in those responsible for their care and maintenance.

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PROSPECTS OF PROMOTION.

BY MAJOR H. E. LANE, R.G.A.

IT is thought that many officers, especially those who joined since 1914, have very little idea of how they stand as regards promotion, and, as Capt. Tuohy remarks in his recent paper on a similar subject, "an unduly optimistic statement on the matter has recently appeared in the Journal." This paper in an attempt to present the situation as it is, supported by facts and figures. The Blue Lists of June 1914 and July 1921, corrected as far as posible from information appearing in the *London Gazette* and the monthly Journal, are the authorities. In 1921 the same number of divisions are allotted to the Expeditionary Force as in 1914 but there are additional forces on the Rhine, Black Sea, Palestine, Egypt and Mesopotamia. From South Africa however, regular troops, except for a company of R.G.A., have been withdrawn. A committee is sitting in India on Indian Army requirements which probably means reductions.

Each regular division has the same number of 12 batteries as in 1914 but in 1914 they formed four Lieut.-Colonel's commands as against three to-day. By studying the Blue List a very good idea can be got of the present day establishments, of course these are approximate only, but are the best that can be arrived at in the absence of the official lists. This is how the establishment in Table B has been produced. A major, a captain and three subalterns being allowed for each battery with an extra subaltern at Brigade Headquarters as Assistant Adjutant. Now the flow of promotion begins at the top with the Lieut.-Colonels who go on half pay after four years in the rank. In addition a number of the other casualties occur—retirements, resignations, deaths, appointments to the staff and so forth, all creating vacancies to be filled by promotion or the absorbtion of supernumeraries Just at present it may be noted that no field officers are retiring for age, but a few captains and subalterns are going at 45 and 35 respectively.

The R.H.A. in 1914 consisted of 9 brigades, 25 batteries, the Depôt, and the Riding Establishment with which 9 Lieut.-Colonels, 27 Majors, 27 Captains, and 90 Subalterns and with 9 Captains as Adjutants were employed.

In 1921 the R.H.A. has been reduced to 5 brigade commands and the Riding Establishment with 6 Adjutants; 15 batteries, the Depôt, and the Riding Establishment employ 17 Majors and 19 Captains. At present the number of Subalterns does not appear to be confined to 3 per battery, the actual number in the Blue List being 75. This shows a considerable reduction in R.H.A.

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ERRATA.

PROSPECTS OF PROMOTION.

BY MAJOR H. E. LANE, R.G.A.

The following amendments should be made in the above article published in the R.A. Journal for November, 1921 :—

Page 367—Table A. 4th line col. 6. *for* 537 *read* 637.

Page 368—At end of sentence commencing "an analysis of col. 6 Table B" delete the words "leaving 4 Majors unposted."

Page 368—The sentence commencing "assuming that no other form, etc."—*for* 9 Majors R.F.A. *read* 2 Majors R.F.A.

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In 1914 in the R.F.A. there were 51 brigade commands providing 51 Lieut.-Colonels, 147 Majors, 165 Captains and 51 Adjutants with regimental employment.

In 1921 there are 42 brigades, 4 divisional ammunition columns and 1 anti-aircraft brigade or 47 Lieut.-Colonels appointments with 47 Adjutants, 169 Majors, 169 Captains and 533 Subalterns for the 144 batteries, 12 reserve batteries, 6 depôts, 4 ammunition columns, and 3 anti-aircraft batteries.

The R.F.A. therefore shows a decrease in Lieut.-Colonels, but an increase in other ranks.

Turning now to the R.G.A.; it is more difficult to arrive at the correct figures as the Coast Defence Establishments appear to be very uncertain. For the purpose of this paper it is assumed that each fire command at home will have a Major and a Captain with no Subalterns.

In this branch vast changes have taken place. Coast Defences at home are moribund as far as the regulars are concerned. Abroad they have everywhere been reduced.

In place of the lost coast defences there is a greatly increased Pack and Medium Artillery Establishment. To analyse figures; in 1914 there were 6 Mountain Brigades with 21 Mountain Batteries as against 10 Pack Brigades and 41 Batteries to-day.

Again in 1914 there were 2 heavy brigades with 6 60-pdr. batteries at home and 3 heavy brigades with 6 heavy batteries in India with a siege brigade of 3 batteries at home and 2 siege batteries in India.

In 1921 there are 9 medium brigades with 36 batteries. In Coast Defences in 1914 there were 51 companies abroad and 32 at home with some local native artillery. This establishment provided for 34 Lieut.-Colonels and 90 odd Majors. In 1921 there are 19 Lieut.-Colonels and 52 Majors and 20 Majors commanding coast batteries which are heavy mobile artillery.

Finally there are two medium reserve brigades and a pack artillery training centre in India which did not exist in 1914.

In the R.G.A. therefore there is a considerable increase in pack and medium artillery and a decrease in coast defence.

All this information can be collected in tabular form, Table A, showing the numbers serving in June 1919 and August 1921, which is only of interest as showing the difference in numbers serving to-day and in 1914. Table B explains itself, column 2 being calculated from the Distribution Blue List.

TABLE A.

Date.	Branch.	Lt.-Cols.	Majors.	Captains.	Subalterns.
June, 1914 ...	R.H.A. & R.F.A.	63	246	351	680
August, 1921 ...		67	389	311	1078
June, 1914 ...	R.G.A.	64	188	356	459
August. 1921 ...		55	346	378	587

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TABLE B.

1	2	3	4	5	6	
Rank.	Establishment.	In extra rgtl. employ	TOTAL. Cols. 2 & 3.	Number serving.	Surplus.	Remarks
R.H. & R.F.A.						
Lt.-Colonel	53	14	67	67	Nil	
Major	183	138*	321	389	68	*does not include Adjts.
Captain	183	95	278	311	33	
Subaltern	608	220	828	1073	245	
R.G.A.						
Lt.-Colonel	41	14	55	55	Nil	
Major	156	133*	289	346	57	*does not include Adjts.
Captain	161	148	309	376	67	
Subaltern	403	118	521	637	116	

The reason that Majors who are serving as Adjutants are excluded is that their appointments are not normally held by officers over the rank of Captain, and it would give a false impression in deducing promotion prospects if they were included as normally extra regimentally employed as such. An analysis of Col. 6. Table B. shows that of the surplus R.F.A. Majors, 47 are now employed as T.F. Adjutants and 24 as regular Adjutants leaving 4 Majors unposted. In the R.G.A. of the 57 surplus Majors 22 are T.F. and Militia Adjutants and 27 regular Adjutants, 8 Majors remaining unposted. It must be considered exceedingly improbable that the Financial Authorities will consent to the promotion of any Captains as long as there is a Major holding what may be termed one of these Captains appointments, the employment of Majors as Adjutants being only sanctioned as a temporary measure to employ the surplus Majors.

Between the present date and the end of 1926, 66 Lieut.-Colonels R.F.A. and 52 Lieut.-Colonels R.G.A. finish their term of service and the same number of Majors are consequently due for advancement. Assuming that no other form of casualty occurs, this, at the end of 1926, will still leave 9 Majors R.F.A. and 5 Majors R.G.A. surplus. These figures fortunately can be discounted by the probability that voluntary retirements will take place. In connection with retirement it must be remembered that in four or five years time many Majors will have almost earned their maximum pension and as such will be more likely to retire than they are now. It may here be well to point out that, in the R.F.A., 1st Jan. 1921, and in the R.G.A., 1st May 1921, saw the promotion of a large number of Majors. Consequently there will be runs of promotion in January 1925 and May 1925. There was a block in promotion immediately following the Armistice in November 1918, consequently there will be similar blocks after November 1922 until January 1925 and again after November 1926 until January 1929. To return to the subject of promotion prospects. It is deduced that the senior Captains in both branches may reasonably hope for promotion in 1926, probably in the summer of that year. It is not

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possible to forecast the numbers as this depends on the unforseen casualties to Majors and also on the maintenance of present establishments.

To deal with the Subalterns. By the end of 1926 it is anticipated that adjutantcies will no longer be held by majors. The R.F.A. have some 70 Majors so employed. The 33 surplus Captains may be taken as absorbing 33 vacancies leaving 37 to be promoted. In addition allowance must be made for the retirement and resignation of Captains. It may be predicted that 50 Subalterns will go up making a Subaltern of December 1914 with 12 years service senior Subaltern.

In the R.G.A. there are nearly 70 surplus Captains but in this rank there are nearly 100 commissioned from the ranks over 50 of whom will have retired for age before the end of 1926, 49 Majors are now serving as Adjutants as in the R.F.A. 49 Subalterns will be promoted to fill the places of 49 Captains who will replace them. This still leaves 21 surplus Captains but this number may be taken as having retired. In addition it is expected that another 30 will have gone. It is estimated that about 70 Subalterns will be promoted in all by the end of 1926 leaving a Subaltern of Sept. 1915 with 11¼ years service at the head of the list. Now for the Lieut.-Colonels and Majors. It is easier to make an accurate prediction though the more senior the rank the greater the effect of unforseen casualties. It is predicted that when promotion comes to a temporary stop in November 1922 that the senior Major R.F.A. will be near the bottom of the March 1900 entry and in the R.G.A. one of the seniors of the June '98 Shop term. By the end of 1926 the senior Major R.F.A. will be some one in the upper half of the Shop term of August 1900. In the R.G.A. his opposite number will be one of the seniors of the January 1900 Shop term.

As a long shot it is predicted that at the end of 1930 the senior Major R.F.A. will be one of the seniors of the December 1901 term. In the R.G.A. compulsory retirement for age of a number of officers commissioned in 1900 will help the younger officers to survive and one of the juniors of the December 1900 term may be expected to head the list.

About that date and in subsequent years many retirements for age must be expected in both branches unless some thinning out process is undertaken. The position of Subalterns commissioned during the later stages of the war can only be described as unpromising. It must be remembered that the normal entry is about 40 to 50 cadets a year from the Shop to which may soon be added a small number of the most promising young N.C.O's. Yet in 1915—300, in 1916—270, and in 1917—155 officers were commissioned in the R.F.A. In the R.G.A. these figures are much less yet they still greatly exceed the normal. The effect of this abnormal entry is to make the position of an officer commissioned in 1917 or 1918 exceedingly discouraging.

In conclusion junior officers will do well to realise that the days of the boy Major and infant Captain have gone for ever, and, as is the case after every long war, a slump in promotion has set in. It is of interest to recall the length of service of officers at the head of each

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rank in June 1914. In the R.F.A. the senior Major, Captain and Subaltern had respectively 28, 17 and 13 years service. In the R.G.A. these figures were 28½, 21 and 13. The only remedies seem to be promotion by selection which too often means by luck, or a thinning out process of existing numbers by a retirement scheme.

The position as disclosed in this paper is gloomy enough without the blighting shadows of economy and disarmament which are beginning to appear. Those Subalterns of from three to four years service and under who are not prepared to serve at least thirteen years in that rank with little prospect of commanding a battery before they have some twenty-three years service had better consider whether civil life does not hold out more attractive prospects to them.

NOTE.—The figures given in this paper are corrected up to August 17th.

Since the above paper was written one Lieut.-Colonel's command in the R.H.A. and two divisional ammunition columns have been disbanded. In the R.G.A. one pack artillery brigade has disappeared. This affects the forecast of future promotion given above.

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THE EDUCATION OF ARTILLERY OFFICERS.

BY BT. LIEUT.-COL. H. P. GARWOOD, D.S.O., R.G.A.

"All thinking men are agreed that science is at the basis of national progress."

Sir Edward Thorpe, President British Association.

"The fault dear Brutus, is not in our stars,
"But in ourselves."

Julius Cæsar. I, ii.

THE Committee's recent request for essays on the subject: "Does the Scientific future of the Regiment necessitate the formation of a special branch of Artillery Experts who shall be sent, on commissioning, to the Artillery College for continuous training in Experimental and Research work," has emboldened the author to submit his views on the subject generally. No single officer is likely to have experience covering all the points to be considered and for that reason many, otherwise better qualified, may refrain from venturing on a topic which is, however, of the highest importance to us all. The present writer has recently visited (as a student) most of the regimental educational establishments here considered and he must make that an excuse for his temerity. In order to induce a suggestive atmosphere some account will first be given of the way in which Science advances behind the barrage of research.

1. WAR AND SCIENCE.

The war showed us that for victory we must throw into the scales not only all our physical and material resources, but also all our *knowledge*. Our scientific leaders—the great universities—glutted with mediæval learning and monastic traditions, had neglected this aspect of national duty and could but tardily adapt such resources as they possessed to military requirements. We can only hope that they have taken the lesson to heart.

Nearly every advance in knowledge has some bearing on the science of war. The difficulty is to realize the practical extent of the advance and its exact capacity for application to military affairs. A nation with universal service has a great advantage in this respect. Its professors and manufacturers have done their turn at soldiering and when they make a discovery they quickly discern how it may be turned to military account. They are also trained in patriotism and do not hesitate to apply their knowledge to national use. Even in such a nation, however, the officers corps—and especially the staff—must be competent to appreciate scientific proposals and to appraise them with judicious sympathy.

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Much more is this the case with a nation whose professors and manufacturers are generally suspicious and even intolerant of military interests. The officers then must not only be trained to appreciate advanced scientific knowledge, but also to seek it out. It is ludicrous for a staff to pretend to control experts if it is ignorant of the fundamental principles on which their work is based.

The army of science to-day is so specialized and advances on such an extensive perimeter that communications are difficult to maintain. On all fronts research is feeling its way forward the world over. Its literature is widespread in journals and pamphlets difficult to collect and obscured by the scientific jargon of many languages. Not a few advances are kept secret for national reasons or because of trade rivalry. For scientists themselves the problem is almost insuperable[1] and the army will not only have to enlist the sympathy of those in the best position to help it, but will also have to fit itself for its own share in the transaction. The efforts of subordinate "experts" can be of no avail unless the officers corps as a whole possesses the knowledge requisite gladly to accept and make effective use of valuable suggestions and also (which is equally important) to be able to recognize charlatans.

The Committee on Natural Science[2] which presented its report in 1918, states "It is hard to see the justification for entrusting the lives and welfare of men to officers who have had no opportunity of getting a secure hold of the knowledge of the simpler laws that govern weather, food, personal hygiene, the application of electricity and optics and innumerable other factors that affect the daily life and work of a soldier. Yet it was stated to us by a witness speaking on its behalf that 'the General Staff had to think of the good of the Service as a whole, and their view had been that the military efficiency of the officers had not suffered from lack of science.' " The Committee entirely disagreed with this view and considered it urgent "that officers of all ranks should have a keen appreciation of the scientific problems involved in methods of modern warfare by land or air and their relation to one another."[3] "The experience of the war," it added "must surely have taught us that the scientific problems suggested by the needs of the Services are so important and so complex that a special permanent organization is needed to deal with them. Whether this need can best be met by developing existing establishments or by setting up a new institution to be shared by the Army, the Navy and the Air Service it is not for us to determine; but we are convinced of the urgent need of such an organization. An establishment of this kind would afford ample scope for those officers of talent who show special aptitude for research and

[1] The *Comptes rendus* of the Paris Academy and the *Sitzungberichte* of Berlin attempt the task of indexing all scientific literature, but unfortunately there is as yet nothing quite fulfilling the same function in England or America, and the latest report of the Conjoint Board shows that scientific investigation is being seriously hampered by the present costs of publication.

[2] Report of the Committee on the Position of Natural Science in the Educatory System of Great Britain, 1918. Sir J. J. Thomson, O.M., President of the Royal Society, was Chairman.

[3] cf. Ruskin's *Crown of Wild Olive*. Address to R.M.A. Cadets.

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whose scientific ability might otherwise be allowed to run to waste. In the direction and control of its work officers of naval or military training and experience should be associated with men of high scientific standing who had proved their activity and initiative in scientific or industrial research not necessarily related to the applications of Science in warfare." May it not be assumed that the majority of gunner officers—so far as the scientific training in their own arm is concerned —agree with the Committee?

2. THE TWO KINDS OF RESEARCH.

Research is of two kinds: (a) research in pure science and (b) industrial research. Military science can expect assistance from both kinds; but the quality of its relations with them will differ, as also will the application of their results. We will therefore briefly consider them.

(a). Research in pure science is, as a rule, carried out by the solitary worker. For many centuries—from Ennius to Newton—it was the only form of research. When the student reaches the confines of his subject, Giant Discovery beckons him to this field of mental adventure. The student's intuition may lead him along some track where previous explorers have already prepared an opening, or he may be tempted into some dull by-path in the hope that, although forbidding, it may yet lead to the Delectable Mountains. "History has shown, not once but many times over, that problems which are improperly conceived at the beginning and may appear hopeless and even fantastic to the majority of intelligent people, may lead to discoveries of paramount importance. In making grants to individual research workers" says the Privy Council Committee,[1] "we are guided not so much by the themes they propose to pursue as by the evidence we are able to obtain as to their scientific capacity. We do not forget how the ideas of Galileo, Darwin, and Pasteur appeared to others at the time of their inception." Research in pure science is mainly carried out at the universities, but enlightened manufacturers are not oblivious of its possible advantages to their establishments.

A government research department in this respect resembles a manufacturer's laboratory and any indulgence in pure research could be expected to produce but meagre results and the inevitable barren period would be attributed by a doubting public to sloth or inefficiency. Such departments are therefore bound to feel that they must at all costs produce "results" to justify their existence. Even if they could afford to go in for pure scientific research, their work would represent but a very small portion of the field traversed by the scientific world at large. And as a discovery in any part of that field may have far-reaching but not immediately discernible military application, it is necessary for the services somehow to keep in touch with all scientific developments which may possibly be of use in warfare. "We believe and have always

[1] Report of the Committee of the Privy Council for Scientific and Industrial Research, 1919-20.

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believed" says the Privy Council Committee, "that the organization of research cannot be expected to lead to great discoveries. As the Lord President (Mr. Balfour) has pointed out: while the State might aid research it would only destroy research if it were resolved to control it. The best men would not be controlled. The State was incapable of forming a judgment on the merits of an abstruse physical or physiological inquiry. That must be left to the genius of the men themselves."

(b). *Industrial Research.* During the latter part of the 19th Century the Germans organized research in connection with certain manufactures and laid the foundation of what is known as "industrial research." Prosperous chemists and opticians established laboratories at their works and endowed research scholarships at the universities to promote the investigation of matters connected, directly or remotely, with their own industries. During the present century the organization of research has made tremendous headway in America, largely because the American public believes in science and a fine research laboratory makes a good advertisement for a commercial undertaking. Mr. A. P. M. Fleming has written an interesting account of this work[1] from which a few extracts may be permitted, because American research is more highly developed than our own and not likely to be so familiar to English readers.

"The term 'Industrial Research' " says Mr. Fleming "is usually held to imply those investigations which have a direct bearing on the development of industry. It must not, however, be overlooked that a discovery made in pure science to-day may find application in industry to-morrow, and that such industrial application, though its precise form cannot always be foreseen at the time, has come to be an expected incident in the after-life of the discovery. In considering the needs of industry pure science research is as essential as that specifically devoted to the attainment of some industrial objective. The greatest importance is attached to contemporary research in sciences where the connection with industry is not obvious. Such investigations may provide raw material for industrial research, and, owing to the interdependence of modern investigations, progress in one science may have a marked bearing on developments in others.

"The main difference between those researches that are undertaken for the purpose of furnishing material for industrial development and those undertaken by scientific men for the purpose of widening the boundaries of human knowledge, is that industrial research is becoming definitely organized to cover certain fields of science, while research in pure science is more spontaneous and depends more on the initiative and will of individual workers."

3. ORGANIZED RESEARCH IN AMERICA.

We can afford space only for very brief details to give some idea of the extent and aim of American industrial research.

[1] Industrial Research in the United States of America, 1917.

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The American Rolling Mills Company (one of the largest iron and steel firms) spent £9,000 on its laboratory and the maintenance costs about £10,000 a year. "The research department has been made the centre of an organization for collecting and distributing to the manufacturing departments all published information of a scientific character bearing on the company's work." The Kodak Company expended £30,000 in its laboratory and employs a staff of 40, of whom nearly half are specialists of high scientific standing. The General Electric Company employs a staff of 150 and spends annually between £80,000 and £100,000 on research. "The experience of the workers in this laboratory has been that investigations in pure science lead almost inevitably, in course of time, to some commercial application, and increasing attention is therefore being paid to this phase of research." The laboratory and administrative buildings of the National Electric Lamp Association at Cleveland comprise seven large blocks of four or five floors each, situated in a park of 79 acres. The employees number 600 and about one-third of the total capacity of buildings and staff is devoted to laboratory work. The Pennsylvania Railroad Company has very extensive research laboratories and a staff of 361, of whom 282 are employed in the physical laboratory, half engaged in the inspection of materials and the rest on physical testing and research work. About one-fourth of the latter group are technical graduates. The remaining 79 men, two-thirds of them with technical training, are attached to the chemical laboratory. The cost of the buildings and equipment was £100,000 and the annual maintenance comes to the same figure. These examples will give some idea of the scope of American industrial research. It is not however confined to the firms themselves, but receives great assistance from the universities and national research institutions.

As an example of University work we may take Illinois, of which Mr. Fleming says :—"Much research work has been carried out in the various departments of this University, both by students for their graduating theses and by the staff, in connection with pure science problems and at the request of manufacturing firms. By far the most important research work, however, is that carried out by the engineering experiment station, which is one of the most important and successful at American universities. It was organized in 1903 for the purpose of conducting investigations of importance to professional engineers and to the manufacturing, railway, mining, and building interests of the State. Its control is vested in the heads of the nine departments of the college of engineering, and these, with the director of the station, determine the character of the research to be undertaken.

"The regular equipment of the laboratories of the engineering college is used for these investigations, but a permanent staff of nine investigators, each of professorial rank, is devoted entirely to research work, and has no educational responsibilities. In addition to this staff there are 14 research fellows, mostly from other universities, who are granted fellowships tenable for two years of the value of £100 per annum each. These fellows spend half their time in research work and

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the other half in preparing for their degrees. The students of the university do not, as a rule, take part in the research work of the station, but the spirit of research is fostered among them by the example of this work. Investigation for private firms is not done by the experiment station, and all results are published and widely distributed free of cost. The cost of maintaining the experiment station is about £10,000 per annum. Apart from the work of this station, very important investigations have been made by the students under the supervision of the staff of the electrical, mechanical, mining and railway departments."

Of the National Institutions in America the best known are the Bureau of Standards, the National Research Council (founded by President Wilson) and the Smithsonian, Franklin and Carnegie Institutions. The last named has an endowment fund of £4,500,000 and its objects are "to encourage in the broadest and most liberal manner investigation, research, and discovery, and the application of knowledge to the improvement of mankind." We would like to draw special attention to a unique foundation: The Mellon Institute of Industrial Research and School of specific industries.

The Mellon Institute was founded about ten years ago by Mellon Brothers, Bankers of Pittsburg (Andrew Mellon is now Finance Secretary in President Harding's administration) in connection with the University of that town at a cost of £66,000. The annual maintenance and salaries run to about £30,000. Its object is to provide manufacturers with the services of a great scientific laboratory and trained staff for the investigation of problems arising in their industries at a smaller expenditure than would be involved in private laboratories. Manufacturers are encouraged to submit their problems and, when these involve research, are required to endow fellowships for a period of one or more years for as many men as are required to undertake the investigation. The work of the research fellows is supervised by a permanent staff which includes seven men of high scientific standing. When a specific research is to be conducted, the director undertakes to secure the services of a suitable investigator, usually a man with a doctor's degree from one of the Universities. Great care is taken to ensure that the candidate is inherently fitted to co-operate with the men engaged in the industry to which the research applies. In this selection the director "considers that personality and common-sense are all-important. He realizes that in the application of science to industry the human element is of much greater importance than in the case of pure science research, where the experimenter does not come into contact with men in industry, who often are not in sympathy with scientific investigation." The results of the research are not published (unless the manufacturer agrees) until three years after their completion. This unique institution appears to have been a success both from an educational and industrial standpoint and it is interesting to note that manufacturers, at the conclusion of a research, are usually anxious to secure the services of the research fellow and thus the highest positions in industry tend to become filled by men of sound scientific value.

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The appointment in the United States of a Naval Advisory Board for dealing with naval engineering problems has resulted in the proposal to provide a very extensive naval research laboratory, and to turn to wide account in some way the resources of universities and manufacturing laboratories. It has been suggested that a government official attached to the proposed laboratory might serve as a link between industrial problems and national research facilities and advise the lines on which co-operation might be effected.

4. LESSONS FROM AMERICAN EXPERIENCE.

"American experience" says Mr. Fleming "suggests a possible arrangement for training research workers in this country. The men might be selected from graduates in the university, who could proceed straight into research laboratories or, alternately, spend the first year or two in post-graduate work at the university. A promising plan is that adopted by one large British engineering firm, which is prepared to employ selected graduates and provide them with some works' experience for a period long enough to acquaint them with urgent industrial problems. Having then selected a subject for research, and while the student is still in the employ of the company, the investigation can be undertaken either at the works or at the university, whichever affords the most suitable facilities. In this way the student has an excellent opportunity of undertaking work of immediate industrial value, and moreover he is brought into useful contact with the commercial atmosphere of the works.

"A great deal of the research work in this country has hitherto been done by men of outstanding genius, and largely on this account an impression prevails that important scientific investigation can only be made by such men, who should be allowed to pursue their course unhampered and undistracted by association with industry. While full credit should be given to the genius who can often achieve so much with very limited facilities, it is a fallacy to assume that research work of great value cannot be carried out by men of average attainments. This is illustrated by the success achieved in many of the laboratories in the States, where, with suitable organization, important investigations both directly connected with industry and in pure science have been dealt with by men of no more than average ability working under competent direction.

"In pursuing an investigation towards a definite goal, it is well-known that many promising ramifications are often disclosed which, when followed, lead to results that may be more valuable even than the original objective. In this way it may often happen that a research carried out in the interests of one industry may lead to results which prove invaluable if applied to some quite different industry. The higher forms of research, more especially those in the field of pure science, should therefore be carried out on national lines, so that any results that are derived can find application in one or other of the numerous national industries."

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5. ORGANIZATION OF RESEARCH IN GREAT BRITAIN.

In Great Britain considerable progress has been made during the last five years in the organization of research, but, compared with Germany and America, we are still only feeling our steps. Educated opinion is still swayed by monastic influences and large sections of the public seem to regard science as a form of quackery. Our genius has been individualistic and organization is therefore difficult. Steady progress however is reported by the Privy Council Committee for Scientific and Industrial Research, in whose prestige and energy our hopes in this direction are mainly centred. During the past year they have endeavoured "so to organize all the scientific work which is of common interest to the fighting services of the Crown as to ensure the utmost economy of expense and personnel, and the due co-ordination of the technical work of the various naval, military and aeronautical establishments, so as to avoid overlapping either with each other or with the research organization of civil departments." To this end they have instituted *co-ordinating boards* with technical representatives of each of the fighting services and independent men of science. Separate boards have been formed for chemistry, physics, and engineering research. From these they anticipate progress in spite of inevitable initial difficulties of detail in working. "The position of the new boards in relation to the rest of our activities" says their latest report "will not only facilitate co-operation between the Government scientific services, it will also enable them to secure the part-time service of professors and other experts working in university or private laboratories with whom we are in close relation, and, through the research associations connected with the Department, enlist the assistance of the leaders of industry." To further the new policy the Admiralty has decided to erect a laboratory for its own experimental work in physics next door to the National Physical Laboratory at Teddington so that the two staffs can co-operate. The Air Ministry is also making proposals for close liaison with the Department of Scientific and Industrial Research. "If firms competing with each other for existence can combine, as they have done, for their common benefit" adds the report, "it ought not to be more difficult for the members of a national service to do so, merely because they are attached to different departments of the Government."

6. THE RELATIONS OF SCIENCE AND GUNNERY.

In order that Gunnery may be elected, so to speak, an "honorary member," in the world of Science, we are faced with three problems:

(a) How to keep touch with the advance of *general scientific knowledge* so that no useful developments may be overlooked.

(b) How best to ally our existing research and experimental *organizations* with workers in cognate fields at the universities or in industry.

(c) How to improve the scientific education of our officers, so that they may be in a position to welcome, understand, and make intelligent use of new discoveries and improvements.

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(a) How are we to make all British scientific workers aware that we have a genuine desire to appropriate any knowledge they may acquire in the course of their studies which appears even remotely of interest to the work of artillery? The Artillery College seems the proper place to receive and digest such information—it should be our regimental university. If the professorial staff could be expanded and freed from all administrative work, communications from scientific workers (however humble) could receive prompt acknowledgement and sympathetic report. If desired, it could be guaranteed that information so given would be treated as strictly confidential. Propaganda to this effect could be inserted from time to time in all scientific publications.

This would be a beginning, but to sustain interest more would be required. Could not the British Association be requested to arrange a day or an afternoon during their annual session for the discussion of naval and military topics? So many men of science have interested themselves in our problems during the war that a spirit of understanding must have been created which it would be a pity not to sustain. Military requirements percolate from time to time into new channels with which it would be necessary to keep scientists acquainted. Periodical exchange of visits, lectures and discussions might be arranged with the various scientific societies, universities and manufacturers in order to stimulate co-ordination.[1]

Arrangements should be made for gleaning, tabulating and widely disseminating all information likely to be of scientific interest to the regiment. Officers would also benefit by advice as to the most desirable scientific books for addition to station libraries. A quarterly pamphlet distributed with the Journal only to officers and approved British organizations would seem a suitable vehicle: leaflets distributed through official channels are apt to hide their light in office safes. Such arrangements could not be perfected at once, but something on these lines appears the only eventual solution.

(b). Into the necessary re-organization of our regimental arrangements for organized research and experiment it is not proposed to enter. Only those with official knowledge of the problems and difficulties are in a position to offer criticisms which will not run the risk of appearing unfair to workers who are perhaps doing their utmost in circumstances brought about by the exigences of war. That the arrangements made under the stress of such conditions were probably never ideal and are, in any case, unsuitable for peace-time routine, may be taken for granted. The writer's own opinion (of which more later) is that all research and experiment in artillery matters should be carried out through and under the direction of the Artillery College—not perhaps as it exists to-day, but as the true regimental university he would like to see it. Precept and practice should be (so to speak)

[1] The President of the British Association for the Advancement of Science said at the Edinburgh meeting in September this year "The military class in every country is probably the most conservative of all the professions and the slowest to depart from tradition." This represents the general verdict and it will require a really great effort to ensure to the rising generation an opportunity to escape the mental atrophy hitherto the stigma of our profession.

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under one roof. Artillery doctrine should be alive, practical, and embodied in the whole regiment.

The article on "French Artillery Doctrine" in the *U.S. Field Artillery Journal*, Jan.—Feb., 1921, (reprinted in our June number) concludes as follows :—

"What surprises has the next war in store for us?

"We must take care to be neither surprised nor disabled. We therefore need :

(1). A service of technical studies, strongly organized, based on a corps of technical specialists belonging to the army, and completed by a minutely prepared industrial mobilization.

(2). Regulations without formalism, written in a broad spirit, permitting every initiative.

(3). Active intelligences, flexible enough to adapt themselves rapidly no matter what form the war takes, or what new devices are produced.

(4). Finally, and above all, we must not forget that an army is worth more for its morale than for its armament and that the morale of the troops is only the morale of the leaders. The future army, based on a very short-term service, will depend much more for its value on its cadres than the army of 1914.

"It is thus necessary above everything else to assure this framework and to prepare the army leaders—officers and N.C.O's—in the same way as the leaders of industry, engineers and shop foremen are prepared. To this end, the first condition is to attract and to retain in the army men of intelligence . . . . . "

7. THE SCIENTIFIC EDUCATION OF OFFICERS.

(c). There can be no doubt that this is the crux of our "scientific future." We may adapt Napoleon and say "there are no unscientific regiments : only unscientific officers." Outside assistance in this respect can be of small avail unless we see to it that the light "which cometh from within" burns bright and clear. One of the witnesses before the Committee on Natural Science stated : "Scientific research on industrial problems is of no use whatever to an uneducated trade. Such a trade can neither state its needs with definiteness or accuracy, nor can it interpret into practice and utilize the results of research. Indeed, it does not feel the need for research and cannot therefore make a demand for it. In some trades it will be necessary to wait for the full development of research schemes until we have a generation of leaders qualified to demand and make use of industrial research." The Committee, in expressing their concurrence with this witness's views, remark that they have in truth a wider application. "It is not only those engaged in industry for whom a better scientific education is required. If Science is to come by its own, the nation as a whole must be brought to recognize the fundamental importance of the facts and principles of Science to the right ordering of our national life."[1]

Natural Science in Education, 1918, p. 235.

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The war caught us with a divorce between the two halves of the regiment which was most unfortunate and ought never to be allowed to recur. To this end the professional instruction given to officers of both branches should be, as far as possible, identical. Even now it is difficult to realize how lucky it was that the dismounted branch up to 1914 had devoted itself so thoroughly to the scientific side of gunnery. Not only in the field, but especially in the less prominent spheres of manufacture and design, this training—devised for quite different purposes—proved literally invaluable. Even so, it is to be doubted whether the best technical training available for our artillery officers prior to 1914 compared favourably with that of our main allies and opponents. Those whom the war threw into contact with regular French artillery officers will be able to form their own opinion on this point. It is however immaterial; as in any case, once we admit that scientific training is necessary, we should be contented with nothing short of the best. It may not be altogether a fair test, but looking through old files of the Journal, it would seem that our present standard in general scientific matters does not compare favourably with the enlightenment of our grandfathers. In old volumes one finds that more officers appear to have been members, and some of them eminent members, of the learned societies. The present is a period of stock taking and our own educational short-comings need to be straitly examined. Our candour in this respect may be the most generous contribution we can render to our "scientific future."

8. THE WOOLWICH ENTRANCE EXAM.

Let us start at the beginning—so far as the Service is concerned. Candidates for Woolwich must be between the ages of 17½ and 19. Is the training required of them up to that age, as represented by the nature of the examination questions,[1] the most suitable for artillery requirements in their after careers? The subjects are as follows :—

OBLIGATORY.

		Marks.
(i).	English (Dictation, Essay, Précis, General Knowledge)	2,000
(ii).	English History	1,200
	Geography	800
(iii).	Mathematics A (Elementary)	2,000
(iv).	French or German	2,000
(v).	Science. Physics	1,200
	Chemistry	800
(vi).	Mathematics B (Euclid, Algebra, trigonometry, statics and dynamics	2,000

OPTIONAL (One only to be taken).

(vii).	German or French or Latin or Greek	2,000
(viii).	Mathematics C (Higher, including a little Calculus) ...	2,000

[1] Our comments are all in connection with the papers set in November, 1920.

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Coming back to these papers "twenty years on" one is at first surprised at the success of the Civil Service Commissioners in combating the monastic traditions of the public schools. One feels that a boy who can do creditably in this examination must have had, in the main, a good and up-to-date general education. It is to be noted that of the 55 successful candidates, none took up Greek and only 8 Latin (the spelling of these was slightly above the average, but was more than counterbalanced by their bad handwriting, doubtless due to the idiotic practice of "writing lines"). The average marks awarded to Latin were 1531 against 1188 for Higher Mathematics, which may of course be due to chance, but seems to indicate a bias on the part of the examiners in favour of the so-called "classics."

The following alterations in the obligatory subjects suggest themselves :—

(a). History. Limit to general knowledge of *World History* prior to the French Revolution. Detailed questions only from the French Revolution to the end of the Great War.[1] It is interesting for boys to be able to "compare the characters of Elizabeth and Victoria, as women and as monarchs," but surely there are more inspiring questions.

(b). Cut out Elementary Mathematics. It is difficult to see the object of giving half the marks for obligatory mathematics to an easy paper and half to a harder paper which takes for granted a knowledge of the subjects already dealt with. This must have originated as a device for ensuring that classical scholars would at any rate be able to gain half marks in mathematics. One obligatory mathematical paper (3000 marks) should suffice. It should demand an elementary knowledge of, at any rate, *the application of* the calculus and some of the questions should be of such a nature that the use of the slide-rule would be, in effect, compulsory.

(c). In the place of the second mathematical paper, an examination in Elementary Engineering (as set for the R.A.F. and, I believe, the Navy) should be substituted. This to absorb Statics and Dynamics and to include questions on the principles of the internal combustion engine.

(d). The choice of modern languages should be extended (as with the R.A.F.) to include Spanish, Russian, Italian, Arabic or Hindustani as well as French or German. In fact, boys might even be allowed to demand examination in approved languages outside the syllabus: a candidate who happened to have a

[1] "The later dates fill tutors with alarm: they see disturbing controversies looming ahead, even 'getting mixed up with politics' and consequent remonstrances from parents and patrons. So the text books have to end at latest with the Reform Bill of 1885—even this is thought dangerously akin to politics—and the pupil is launched into the world with a large gap between the year when his history books stopped and the time when his own experience began—precisely the time about which his knowledge ought to be most accurate."

Westminster Gazette, July, 1921.

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knowledge of Chinese, Cape-Dutch, Czech, Polish, etc. would be particularly valuable to the service and should not be handicapped.

(e). In the science papers one question could well be devoted to matters of current interest to ensure that the boy had been given a live understanding of his subject. e.g. In the General (English) paper candidates are asked to select *two* of the following and state what they know of them :—J. R. Clynes, General Dyer, Lord Fisher, Thomas Hardy, Lord Kelvin, Rudyard Kipling, and Robert Smillie. In the same way in the Science paper they might be asked to elucidate *two* of the following :—Mazout; motion study; the two-stroke engine; the optophone; thermionic valves, the Michelson-Morley experiment; and vitamins.

In the optional subjects a bigger choice might be given, to lend boys free scope for their inclinations and to cull knowledge from a broader field. Greek could undoubtedly be dispensed with. Latin should be limited to translation *from* the Latin and even that only from Cæsar, whose incomparable military style is invaluable in the service. The subject however should include Roman History (which is exemplary for future soldiers) and literature. The following might prove suitable optional subjects, *three* to be selected :—

(i.) Higher Mathematics (including statistics).
(ii.) Formal Logic (a much neglected subject).
(iii.) Electricity B (including wireless).
(iv.) Engineering B (including steam engine, turbines and heavy oil engines).
(v.) Social science (of increasing importance).[1]
(vi.) Astronomy, navigation and meteorology (useful general training for gunnery).
(vii.) English literature and poetry (helpful to the imagination sadly wanted in military life).
(viii.) Political economy (helpful in administration).
(ix.) An extra modern language.
(x.) Latin and Roman History (as above).

Probably a better list of optional subjects could be easily devised, but the writer has been guided by a consideration of those branches of knowledge which he has found useful or felt the lack of during his service.

9. THE EDUCATION OF CADETS.

The Committee on Natural Science in Education report as follows : "It is evident that Cadets who possess high scientific abilities are not given sufficient opportunities for developing them at Woolwich and,

[1] "Science without Sociology is imperfect, but with it the artificial division between scientific and humanistic studies disappears." Professor Desch at Congress of Universities, July, 1921.

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when they leave, little encouragement is given them to improve their scientific qualifications for the benefit of the country. We were told by a witness :—'Practically all the abler cadets got into the Engineers, but, broadly speaking, the fact that a man had high scientific abilities, gave him no advantages in his military career.'

"At Woolwich, though Science is a compulsory part of the course and adequate time seems to be given to it, the results are disappointing, especially in view of the ability of the successful candidates. It seems a pity that greater efforts are not made to give Science a more important place in the course. The equipment is inferior to that of Dartmouth[1] and the system seems, in spite of some obvious advantages, to sacrifice educational efficiency to less important considerations.

"Candidates of sufficient ability are at present found for Engineers and the Artillery, and in the Academy they are trained to be efficient; but much more than mere efficiency is required in modern warfare, and steps ought to be taken to encourage in every way possible those—and there are many—entering the army every year who have distinct abilities in a scientific direction."

Everyone will agree that in view of their age, the scientific and professional instruction of cadets at the R.M.A. is of the highest importance and should be the best we can possibly procure.

In many ways no doubt progress has been made since the above strictures were penned. In fact, the cadets are now so thoroughly well turned out in most respects that one is reluctant to offer criticism. But it remains a fact that their scientific and mathematical standards are deplorably low. The French officer instructors say[2] "that whether from the moral point of view or from the physical point of view they did not know, till they came here, that there existed anything quite so fine as these English cadets. From the intellectual point of view, and from the eductional point of view, on the other hand, they could not, so they declare, have conceived so great a waste of good stuff as was exemplified by those same cadets." Sir Ian thereupon suggests that if it is a choice between fine fellows and clever fellows we may consider ourselves lucky to have such fine ones. But why on earth should our fine youngsters not be also decently educated?

It is much to be regretted that it was not found possible to move the "Shop" to Sandhurst. Not only would this have rescued our cadets from the atmosphere of what is, in truth but a London slum; but it would have enabled them to receive their military education in close harmony with their brother cadets in the other arms.

It is indeed a pity that it has not been arranged to enlarge altogether the scope of the education offered at the military colleges, so that civilians destined for quite other professions could have been taken in addition to military cadets. Such an arrangement has the advantages of providing a reservoir of business and professional men with

[1] The writer could not help being impressed with the excellent scientific equipment provided in the Turkish military schools at Constantinople.

[2] *The Soul and Body of an Army*, Sir Ian Hamilton (p. 224).

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some knowledge of military affairs; of advertising the value of the disciplined efficiency provided in a military establishment and so sadly lacking at most universities; and of acting as a tell-tale on the quality of the education provided. Duntroon itself, modelled designedly on the lines of West Point, is unfortunately lacking in this important provision.

It would seem that some advantage to both might accrue from a closer liaison between the civilian teachers at the Academy and the professors at the Artillery College.

10. THE TRAINING OF YOUNG OFFICERS.

When artillery officers receive their Commissions, their scientific training depends too much on chance and their own inclination and opportunities. It cannot be said to be thrust upon them. The procedure adopted by the Royal Engineers at the S.M.E. might with advantage be adopted for young artillery officers. After leaving the Academy and receiving their Commissions, they could serve for six months of a year with their units, where they would learn for the first time the exact nature of their military duties, and gather clearer ideas of the value and method of applying their knowledge. They should then be re-assembled for at least six months at the Artillery College and be put through a good professional course, given an opportunity of passing their first promotion examination, and returned to their units or given leave pending posting abroad. Something on these lines was tried in the case of R.G.A. officers just before the War and was, I believe, highly successful. Now that officers are retained at home until they attain a certain age, there should be little inconvenience in carrying out such a programme. The course might begin with the furlough season, so that officers need not be absent from their batteries during the summer training.

Will this suffice? It is doubtful. Has not the War shown that the gunner needs just as high a technical standard as the sapper? Did we not have to call on the sister Corps to help us with some of our most difficult work? The young gunner officer would certainly benefit if he could receive somewhere a professional training similar to that which the sapper Y.O. gets on joining at Chatham.[1]

11. THE ARTILLERY COLLEGE.

The functions of the Artillery College and the School of Artillery correspond in the main with those of Greenwich and Whale Island (*H.M.S. Excellent*) in the Royal Navy. The comparison at once brings to light certain shortcomings. The Artillery College, even before the War, was by no means an institution to which officers in general looked for leading and instruction in professional matters. Greenwich has

[1] It is open to question whether the post-war sapper is not *over* educated. Two years at Woolwich, two years at Chatham and a year at the university; the total period represents more than 30% of an officer's average service career. The new regime however, increases altogether the disparity between the intellectual equipments of sappers and gunners.

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become in a very real sense the Naval Staff College and in addition all sub-lieutenants receive their theoretical training there and many useful courses are held annually. We could wish that the Artillery College were in a better position to fill a similar rôle for the Royal Artillery. One feels that it ought to be for us a university and that many alterations will be necessary to attain such an ideal.

In the first place, Woolwich is a most unsuitable place for such an institution. The atmosphere is uncongenial for intensive study and the buildings are cramped and scattered. It would be much better if the Artillery College could be transferred to Shoeburyness, where accommodation could now presumably be made available and where the experimental ranges are on the spot.

It is impossible to treat fully in this paper the actual details of what is desirable for such an establishment. The whole status of the College wants to be raised and its attitude with regard to the Regiment and the Regiment's attitude towards it entirely altered. The move to Shoeburyness might assist in this direction, because we are accustomed to look on Woolwich as the traditional headquarters of the Regiment and this, in a vague way, has the effect of overshadowing the prestige of the present Artillery College. It is, after all, only a part of Woolwich, in the same way as the Mess, the Arsenal, the Academy and the Institution are other parts of the whole which the mind accepts as "our headquarters." At Shoeburyness, the College would stand alone and become, as it were our *intellectual* headquarters. The old school of gunnery would recapture some of its former glory as the home of artillery light and learning.

"It is the duty of a University" says Professor Zimmern[1] "to undertake what is called 'research', that is, to increase human knowledge, or, by interpreting existing knowledge, to increase our understanding of it. That is a task which has always been associated with universities, but in recent times, when the teaching function of universities has come more to the front, it has been apt to be neglected or relegated to the interstices of a busy teacher's time. It is often forgotten that teaching and research are different kinds of work, and often best undertaken by different persons. The 'researcher' is primarily interested in his subject: the teacher is primarily interested in his students. The two interests, happily, are often combined; but all modern universities should find room for a certain number of those rare and difficult minds who find their highest satisfaction in simply adding to the accumulated store of human knowledge."

Colonel Rickard in his Prize Essay and speaking from intimate experience has insisted on the necessity of the Artillery College becoming the "guide and adviser of all regimental officers with a view to kindling greater respect for itself as an authority on technical subjects." He has made several interesting proposals to further enthusiasm for this object and possibly the inducements of better pay and prospects for technical officers and his other suggestions are, in practice, the most we can expect in these hard times to help forward

[1] Educational Year Book, 1918.

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any scheme for enhancing military efficiency. But, at the end of it all, will not the "garment of our education" remain a patched up affair, ill-fitting and of doubtful utility? It is in the hope of pointing, however vaguely, to some "prearranged final completion" of our professional education that the present notes have been strung together. If the Artillery College can be made the *brain* of our regiment and given the authority over its members which a decently constituted brain should possess, it would seem that all the subsidiary educational cells and tissues would right themselves in process of time under the healthy guidance of the College itself. It is therefore the most important part of our professional constitution and no efforts will be ill spent that help to stimulate its prestige and increase its utility. The question remains: Can we achieve our object by tinkering with the existing institution or is some more drastic move necessary? The *premier pas* is always important and perhaps in this case should be a big one.

In framing the new constitution of the Artillery College special care would need to be devoted to the formation of "atmosphere." It is important that all officers of the regiment should be at home in the college and not regard it as a place for high-brows and what the schoolboy calls "swots". The teaching must be of the highest quality and arranged to the best advantage. It will probably be desirable to overhaul the arrangements of the Ordnance and Gunnery Staff Courses and alter the emphasis. There seems no doubt that much of the highest professional training now given to the Advanced Class is lost to the Regiment generally and also that the general raising of the standard of knowledge throughout the Regiment is preferable to the intensive culture of a limited number of gunnery specialists. The problem is really deeper still and involves the division of responsibility between the Regiment and the R.A.O.C. as regards the provision and care of our weapons and the technical supervision of our ammunition. It would clear the air and result in great economy of effort if this question could be thrashed out and placed on a logical basis.

All instruction, other than that necessarily given in the field, should be undertaken by the Artillery College. General science (mathematics, physics, electricity, chemistry, and engineering) should occupy a prominent place in the syllabus. The principles of gunnery, tactics and manœuvre should come next; followed by detailed instruction in guns, carriages, range-finding, surveying, ammunition, and motor-transport. Great importance should be attached to abstract knowledge and theory. An introduction to general scientific questions, perhaps quite unconnected with one's profession, stimulates the intellect and broadens the mental outlook. This is specially the case in peace-time, when routine duties are prone to have a cramping effect on the vision. It would be well, on the other hand, to have a model detachment, so that young officers could see an example of the best methods of interior economy, administration and hygiene from which to obtain a standard as regards their own units.

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The main function of the College would be the training of gunnery staff officers, instructors and technical officers. For the last named, most of the instruction could probably be advantageously transferred to the more modern universities and armament firms. Young officers would receive their first training at the College and it would be an excellent arrangement if all lieutenants nearing promotion to captain could also be given a suitable course followed, if necessary, by an examination to take the place of artillery subjects (e) in the present promotion examinations. This would be following the successful naval practice. There would also be senior officers' courses, refresher courses for officers and N.C.Os. and special short courses for officers home on leave from abroad, in addition to such technical courses in range-finding and optics, survey, etc. as might prove necessary from time to time. The technical (Ordnance Course) officers and artificers now trained at the College would still have to do most of their practical work at the Arsenal or elsewhere, but a suggestion is made later which may be helpful in this respect.

The College should be responsible (under the Director of Artillery) for the formulation of artillery doctrine, the collection and dissemination of intelligence and the preparation of text-books. The Commandant of such a College would necessarily be an officer of high rank and attainments. For the present, in order that the greatest field of selection may be covered, it would probably be advisable not to insist on a *p.a.c.* qualification for the post. In this connection it is not unprofitable to recall Prince Kraft's appreciation of the character of that 'original phenomenon' General von Hindersin, the founder of the Prussian School of Gunnery.[1] "Though he was educated in all kinds of science, he yet cared nothing for the 'science' of the arm, but set practical and tactical considerations before all knowledge. Whilst the very highest authorities were constantly at work to introduce, by means of orders and criticisms, a proper tactical employment of artillery; Hindersin strove by the development which he brought about in the arm itself to qualify it for its proposed employment.

"He was a man essentially of the old school, and yet he supported every new discovery and every new idea. He even received novelties which he came across with gladness and zeal, and used indeed to lose his temper when difficulties appeared or when such novelties were criticised. But he never confused the criticisms with the critic. On the contrary, he afterwards quietly pondered within himself upon all that had been said, and when he was convinced, gave up his former ideas at once. When, having considered the whole matter, he arrived at the conclusion that the new idea was correct, he set to work with that tenacity which alone can give life to anything.

"In order to be able rightly to estimate anything new in his department, he not only had all fresh discoveries laid before him, but he also attended all the military lectures which took place in Berlin, and was able sometimes to extract something worthy of notice from

[1] *Letters on Artillery*, Letter XI.

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even the most immature ideas of the youngest officers. During one winter he collected together periodically of an evening, in the lecture-rooms of the School, the generals and field-officers of the artillery, and had discussions carried on before them by officers of the School of Gunnery and the Ordnance Committee on the subject of the latest inventions. He asked perhaps too much of their intellectual power, and soon had to give up this undertaking, since he convinced himself that those whom he wished to instruct were of too high standing and too old to be collected together for instruction."

12. THE ARTILLERY SCHOOL.

The Artillery School would be responsible, under the College, for the strictly practical side of the training. Any over-lapping or lack of co-operation would thus be avoided and the staffs could be, within limits, interchangeable. During the winter months in fact it would be best if most of the staff of the School could be absorbed by the College in order to co-ordinate instruction, exchange ideas, and prepare experiments for the following season. It seems reasonable to place the College (as we have just pictured it) above the School, because the former would represent the brain of the system and should be paramount.

13. ARTILLERY RESEARCH AND EXPERIMENT.

"The side of the College devoted to research on all the high branches of Ordnance work and to specialized training of officers seemed to us much less developed than we should have expected," writes the Committee on Natural Science. "We think that the College ought to be primarily an institution for the highest research and experiment on artillery questions and for familiarizing officers with the results of such work and its application in the field." Progress has certainly been made since the above was written and along the lines suggested. Yet one cannot but feel that if the College is to attain the standing of an artillery university, all research and experiment should be under its supervision or direction. Regimental officers attending the College should be given every opportunity of interesting themselves, as opportunity offers, in the experimental work in progress.

In the past there has been a tendency to keep research and experiment in water-tight compartments. Imagination in an experimental officer has been regarded as a dangerous talent: his duty is limited to carrying out his instructions; observing faithfully; and reporting. Perhaps this view requires revision. A competent research officer can not only report faithfully on an experiment; but his training should enable him to note finer points and perhaps draw valuable conclusions. At any rate research cannot be carried on without experiment and the two should go hand in hand.

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14. SPECIAL ARTILLERY EXPERTS.

We have got so far without the Prince of Denmark—the proposed Artillery Experts. As *experts* the writer is of opinion that they would be a disadvantage to the Regiment from a scientific standpoint. Mankind distrusts the expert and usually considers him impractical. If by any chance the Regiment came to rely on the experts, officers would be neglecting their own responsibilities. The idea, however, of tapping the universities of a limited number of selected science students for a period of post-graduate work with a view to obtaining commissions seems an excellent one. They should be recommended by their universities as possessing elementary military knowledge, character, etc. and should be approved by the professors of the Artillery College as to the line of work proposed and their capacity to undertake it. At the conclusion of their enquiry (or after a stated period)—if still recommended by the Artillery College—they should be attached to a unit for some months. If finally approved as regards their military duties, they should be granted commissions from their date of first joining the College and take their place (for a time, at any rate) as ordinary regimental officers. This plan promises to assist a number of keen research students to pursue lines of study they might not otherwise be able to afford and at the same time to provide the Regiment with a little leaven of university trained scientists.

To effect liaison with university work we should go even further. A number of officers should be selected every year to attend universities. The universities should be those most likely to give training with practical application to artillery work: Cambridge, Birmingham, Sheffield, Leeds, Owen's College, or Liverpool. The officers selected should not have less than four years service and not be over 28 years of age. After obtaining their degrees, they would do work for six months or a year at the Artillery College and be classed as *p.a.c.*

"The advance toward a better order of things is vague and indeterminate." It is Anatole France who is speaking in the guise of Monsieur Bergeret. "The profound and innumerable forces which chain man to the past cause him to cherish its errors, superstitions, prejudices and cruelties as precious symbols of his security. Salutary innovation terrifies him."

In the final event, the officers of the regiment are solely and entirely responsible both for the soundness of their material equipment and for their professional doctrine. They cannot pass on any part of this responsibility to outsiders, but must themselves prepare to meet the exigencies of their "scientific future." To make ourselves an "educated regiment" there is no royal road and the temptations are many to dally in pleasant places by the way.

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SOLDIERING UNDER JOHN COMPANY.—II.

An Officer in the Madras Artillery, 1779-1820.

[BY ONE OF HIS GRAND-DAUGHTERS.]

Reprinted from "The Pioneer Mail," July, 1921.

IN 1781 Lieutenant Bell entered on his first military campaign, when Sir Eyre Coote arrived from Calcutta in the January of that year to take personal command of the army assembled under Sir Hector Munro at St. Thomas' Mount to oppose Hyder Ali, whose troops had invaded the Carnatic with alarming success.

"The first occasion that offered for my smelling powder (apart from the artillery practice at the Mount) was by an attack by two or three battalions of sepoys, with 2·12 pounders and a few 6-pounders for the relief of Fort Cumargooly, 50 miles from Fort St. George held by the enemy who resolutely shut its gates on the approach of the grand army."

Lieutenant Bell and his "Chum" O'Brien, the ugly Cadet, were ordered on service for the assault, when "2·12 pounders were brought up to the outer gate, and 4·6 pounders on the glacis to keep down the fire from the ramparts where the killedar and other officers of rank were killed. The gates were blown open and the place carried after a very gallant defence," in which O'Brien was slightly wounded in the thigh, and 11 of the 13 men with Lieutenant Bell's 2·6 pounders killed.

"The Commander-in-Chief was greatly pleased with the execution of this assault, and announced in G.O. of the 22nd January, 1781—'The European Artillery proved themselves what the enemies have so long known them— the best of troops.' "

Hyder's army was at that time receiving its supplies by sea. "A ship of his loaded with elephants was captured and, elephants not then being used in the public departments of the coast army, individuals became purchasers. A whist party played a rubber for elephants, and the result was a bumper."

Receives his First Wound.

On the 20th June 1781, Lieutenant Bell received his first wound, during an unsuccessful attack on the fortified Pagoda of Chillidrum where his "guns were posted at the end of a wide street looking towards the Pagoda, exposed to annoyance from Gingal Pains (peons) or sharp shooters. In a few minutes my sergeant was shot through the head, and I received a Gingal ball completely through one thigh, scratching the other." This injury fulfilled a "prediction or prophecy made a few days earlier by a brother officer, who, sitting next me placed his hand on my right thigh, saying—Robert, the first time you go where there is fighting you will be wounded here. On the report reading the lines that I had been wounded this prophet hastened to meet the pallinkin bearing me to camp, and entreated my forgiveness for his unmeaning folly."

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The wound was not dangerous, but it compelled Lieutenant Bell to return to Madras, and, to his deep regret, prevented his taking part in the defeat of Hyder's army of 100,000 men at Porto Nova on the 1st July, 1781, by 8,000 British under General Coote.

"Early in August I rejoined and was with the army at the siege of Tipparere, and the battles of Politore and Shoolinghur," having afterwards the unusual experience of being besieged in his turn in the Fort of Tipparere by Tippoo, who withdrew his forces as soon as the grand army approached.

Adjutant of Artillery.

"In March, 1783, I was made Adjutant of Artillery with the grand army at Arcot until, in April, I was sent to St. Thomas' Mount to receive 400 welcome recruits from England," who were soon employed in an attack on the French lines at Cuddalore.

"After a long, well-disputed day the lines were forced and the enemy driven into the Fort, with considerable loss on both sides. In a day or two accounts were received of peace with France, and a kindly intercourse took place between the two camps."

During the next four years Adjutant Bell remained at St. Thomas' Mount, well occupied with the duties of his appointment; performing, in addition those of a chaplain for a stipend of 50 pagodas per mensem, as there were then only two chaplains in the whole Madras Presidency. In this clerical capacity he tells us: "I performed the several ceremonies, marriages, christenings, burials, even divorces, and on one occasion christened six infants before breakfast." He also started a tennis and fives court, in which he vanquished two of his sons 33 years later, and not only found time to build "a comfortable four-roomed house, with out-offices and surrounding walls," which he sold for 500 pagodas later on, but also to marry in July, 1787, his first wife, Miss Sarah Sydenham, a union which brought him great happiness during the eleven years that it lasted.

Siege of Bangalore.

Appointed Commissary of Stores in 1791 with the army under the personal command of Marquis Cornwallis, he took part in the siege and capture of Bangalore, when on 21st March "the breach being practicable the Fort was stormed at night. Having made enquiry of an Irish sub-conductor, who came from the trenches for ammunition, what prospects there was of completing the breach he replied: "Breach or no breach, depend upon it they will get in. Sure, it is open at the top."

On the 22nd May 1791: "In consequence of the dearth of draft and carriage cattle and general distress, the destruction of the battering train and equipment was ordered, and 1,000 lbs. of gunpowder was destroyed by being started into a large well, which, when full, was ignited by accident from a lighted stick thrown into the well, when the explosion caused a strong sensation in camp, very few having any knowledge of the cause. On the destruction of the battering train and

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stores, which though unavoidable, rendered a public record necessary I was placed in arrest on most heinous and extensive charges. The proceedings of the general court-martial developed a jealousy amounting perhaps to conspiracy; but the result was most creditable to me, and the sentence unprecedented in limiting the Commander-in-Chief to a slight reproof."

Furlough after 18 Years.

After 18 years of such really "active service" in India, "I obtained in January, 1796, a furlough, the first granted on the new system, and embarked with my wife, two sons" (an elder boy had been already sent home to relations in London) and the faithful ayah, Seppia, on board the Lord Thurlow. Being due to call at Colombo we were drifted by an extraordinary current, not usual there at that season (February), running upwards of 6 knots per hour, and struck on Point Pearo, but soon got off without injury. The Lord Thurlow had made the outward passage to Madras in 3 months 3 days, without once tacking ship, a very extraordinary occurrence."

There is perhaps nothing much more sweet in life than a man's first home leave, well earned by active service, and it is hardly necessary to say how keenly Major Bell enjoyed his first, and only, furlough in England.

He first settled with his family on the banks of the Thames at Putney to be near the kind kinsfolk with whom his eldest boy was living who had taken a house there for the summer. From thence he daily accompanied his cousin, Mr. Hugh Bell, to his business in the city, "by a small boat rowed by one man, returning in like manner in the afternoon" (what a delightful contrast to the tube and bus struggles of these days), "never neglecting to pay a visit to Dolly's chop house, where we had most comfortable tiffins of prime beef steaks, or veal chops with delicate French beans, to me a delicious treat."

His Residence in England.

Later on he took a house in Charter House Square, "to me the most desirable situation in town," where the only thorn in their roseate existence was "the unreasonable conduct of the servants" : a complaint of all the ages. "A housemaid could not remain because she got mutton for dinner 4 days in a week; a footman could not sleep in a bed with such thin curtains" and so forth.

He paid a visit to Dublin, which he found "much improved by public and private buildings, but no change in the wretched tribe of ginglers, shoe blacks, and newsmen"; and "the distracted state of the capital at the time Lord Ed. Fitzgerald was assaulted in Thomas's Street induced me immediately to return to England."

Death of his Wife.

With his family he visited Bath and Cheltenham. At the latter place his happiness was brought to an untimely end by the tragically sudden death of his wife one Sunday morning, when she was preparing to go to church, her husband being absent in London at the moment.

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This terrible loss resolved him to return at once to India, leaving his children with their hospitable relations, and, as the season of sailing had passed for the regular ships, he went to Gravesend in search of a private passage for himself, a niece, and a young friend, who had been promised his escort to their relations in Madras and whom he would not disappoint, even in his altered circumstances. With his usual good fortune he happened upon a fine ship sailing shortly for Madras commanded by a Captain Richardson, who willingly accepted him and his charges as passengers, as he was anxious to have lady companions for two young cousins from Dumfrieshire named Scott, sailing for Madras under his care to their aunt, the wife of General Harris.

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THE REGMENTAL JOURNALS OF THE UNITED STATES ARTILLERY.

In the last number of the Journal of the Royal Artillery some general account of the nature and scope of the American Artillery Journals was given. It is now proposed to deal in rather greater detail with the last numbers of these Journals to reach England, in the hope of inducing more officers to read them for themselves. They can always be obtained on loan from the Institution.

The principal paper in the *Journal of the United States Artillery* (the Journal of the Coast Artillery) is an excellent translation of a lecture by Colonel Maistre of the French Artillery. The Subject is one of interest to all gunners, namely, "The Evolution during the War of Ideas concerning the Employment of Artillery," and it is treated with knowledge and judgment. This, indeed, was only to be expected, for the author, after extensive experience in the field with the French Artillery, was selected on the arrival of the American Expeditionary Force for the important post of Chief of the French Mission to their Artillery.

Commencing with a short statement of the pre-war Artillery "doctrine" in France, he goes on to show how, without any revolution in principles, methods gradually changed *pari passu* with the increase in the strength of the artillery and the progress in gunnery. In a clear and concise historical resumé, he traces the evolution of ideas from the discovery of the importance of heavy artillery in 1914, through the period of the Great Bombardments, to the surprise attacks and Intensive Neutralisation of 1918. The development of scientific observation and of counter-battery work "in spite of the opposition of the High Command and of the Infantry" are duly noted in their places; and the whole is supported by notably well arranged tables. These give the strength of the French Artillery in personnel and matérial at various periods, the density of guns and the expenditure of ammunition in the principal attacks, and in fact just as much statistical information as is required in an easily digested form.

But the most important part of the lecture is that dealing with the thorny subject of Organization and Command. The account of the efforts to establish an adequate system of artillery Command, with its description of the break-down of the original machinery, the first timid attempts at improvement, and the opposition of the Staff to any extension, will recall many of our own experiences. So, again, will the recital of the difficulties in evolving an Organization suited to the great increase in artillery strength, and the struggle for the Heavy Artillery between Corps and Divisions on the one side, and the General Reserve on the other! Finally the lecturer does not shrink from stating his own views on that most controversial of topics—the ideal constitution of Divisional Artillery.

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But if the place of honour is given to a translation, it must not be thought that there are not many valuable contributions from American officers. Especially to be noted are several papers on the use of balloons as artillery adjuncts, and the Editorial on the "Passing of the Brigades" which will touch a responsive chord in the breasts of many on this side of the water. When the Expeditionary Force returned to America and the time came for a return to peace establishments, the Chief of Coast Artillery made a great effort to preserve, in cadre at any rate, the three[1] Brigades of Heavy Artillery which had been formed from that corps for service in France. Now, alas, the demands of economy have prevailed over those of sentiment, and their doom has been pronounced. All those who served in our "Heavies" will sympathise with the regret of their American comrades.

In the *Field Artillery Journal* though there are several articles of foreign arigin—notably a reprint of Sir Noel Birch's paper in the Army Quarterly—the place of honour is reserved for one of the Prize Essays. Under the American rules each competitor is now free to choose his own subject within very broad limits, and the result this year would seem to warrant the experiment. Certainly the essay which appears in the number under review is a valuable contribution to the discussion of the very difficult problem of "The Accompanying Gun."

The author has not allowed himself to become involved in the technical side of the question, though he states his views regarding the main conditions to be fulfilled by such a weapon, and gives his reason for considering that "the tank" as at present constructed and tactically used does not find its rôle ever as an accompanying gun." His object has rather been to discuss the general questions of the advisability of detailing single guns[1] to accompany assaulting battalions.

After the Armistice the American Expeditionary Force carried out elaborate experiments to ascertain the relative values of "an accompanying gun" and "a supporting battery" in the case of an assaulting battalion being held up. Of course it is impossible to really reproduce the conditions of such a critical moment, but these trials, conducted under the closest possible approach to service conditions, immediately after the cessation of hostilities, are stated to have shown that the quickest way to break down the opposition and relieve the infantry would generally be by the use of the accompanying gun. The author's conclusion, at any rate, is that this must be accepted as a probable battle requirement, and that artillery officers must therefore be trained for such a duty. He does not attempt to minimise the difficulty of the problems that will confront an officer charged with such a mission, or to conceal the many failures that occurred in actual practice. He gives good reason, however, for ascribing these to the insufficient training of both artillery and infantry, and draws a vivid picture of the bewilderment of the poor gunner subaltern, who never

[1] In the United States the artillery is organised on a logical basis, in Brigades, Regiments, Battalions, Batteries, Platoons and Sections.

In America a Section. (See footnote on p. 3.

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knew whether he was going to be warned off by the infantry as a dangerous nuisance: or, perhaps even more embarassing, hailed as a saviour, capable of establishing with his single gun an impenetrable defence along a whole battalion front!

His conclusion is that when an accompanying gun has carried out its mission successfully in battle, the resulting confidence of the infantry in its own artillery has been so marked as to materially raise the infantry morale; and that preparation for such work gives the best possible training to artillery subalterns in "esprit, technic, manœuvre ability, infantry co-ordination, and initiative."

In the previous article, already referred to, it was explained that "Army Ordnance," the Journal of the United States Army Ordnance Association, should really be classed among Artillery Journals. Its present number fully bears out this contention, for it contains excellent descriptions of modern artillery matériel, ranging from the disappearing mounting for the new 16-inch coast defence gun, through caterpillar adapters for 8″ Howitzer and 6″ guns, to the latest type of split-trail carriage for a "75". But the outstanding feature of the number is the account of the Bombing Trials carried out last summer in Chesapeake Bay. Everyone has heard of the sinking of the German ships by the American Air Services, and many have read somewhat sensational descriptions, but officers without access to confidential documents have had little chance of hearing the true story. Here we have a straightforward account, supported by extracts from official reports, and profusely illustrated with diagrams of the bombs used and photographs of their effect.

It may be as well to recall the salient features of the experiment. Four surrendered German ships were sentenced to destruction—two submarines, the light cruiser *Frankfort*, and the dreadnought *Ostfriesland*. These were all sunk at anchor by bombs varying in size from 170 lb. to 2,000 lbs.; in addition, the *Iowa*, an old American battleship, steaming under wireless control, was used to demonstrate the ability of aeroplanes to discover and bomb a ship in movement. The account of the trials is very complete, and it is moreover followed by Articles on *Bomb Ballistics* and on *Anti-Aircraft Defence*, which shed more light on the subject. But it is too large and too technical to be summarised in such a notice as this. The conclusions of the Joint Army & Navy Board who conducted the trials are especially worthy of careful study by all those who are interested—and what Englishman is not?—in the problem of ships *v.* aeroplanes. We may well agree with General Williams, the Chief of Ordnance, who so aptly summed up with the phrase: "A bomb was fired to-day that will be heard around the world."

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—November, 1921.

I. Operations of the Belgian Army 1914-1918. (Continued).
II. The Problem of Tactical Security. (Continued). Lt.-Col. Van Emelen.
III. Ground Observation of Artillery Fire. (Continued). Lt.-Col. Grade.
IV. Modern Searchlights. (Continued). Major Pirot.
V. Mobilisation of the Nation for War. I. Capt. Comdt. Dendal.
VI. Apparatus for instruction in laying. Capt. Comdt. Wilmotte.
VII. Notes on Foreign Armies.

Germany.—The new Army carried out manœuvres in September.

Manœuvres took the form of camps of instruction, and Divisional Training following short periods of training earlier in the summer.

France.

Revue Militaire Générale—October, 1921.

I. The mishaps of a Marshal of France. II. (Continued.) Lt.-Col. Revol.
II. Strategy and Operations, Chapter III. Operations in Alsace and Lorraine—Battles of Sarrebourg and Morhange. Capt. Kuntz.
III. Albania . . . . . Gen. Salle.
IV. Comparison of Infantry Fire tactics before and after the war—Part II. Capt. Laffargue.

Revue d'Artillerie.

I. Errors due to difference in level of wheels. Lt.-Col. E. Pagezy.
II. Artillery Observation. Major Apffel.
III. Employment of Artillery in Morocco. Major Canova.
IV. The Dawn of Triumph. (Continued). Major H. Brun.
V. Fire Tactics. (Continued). Col. Cambuzat.
VI. Methods of Analysis of the Ferrozirconia.
VII. The German Artillery Firing Manual of December 4, 1919. (Continued).

Notices of Books. "Le Grand Etat-Major allemand" analysis and translation of von Kühl's "Der Generalstab"—by Gén. Douchy. Payot, 1922. 6 Fr.

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Switzerland.

Revue Militaire Suisse—October, 1921.

I. The Operations on the Sangarios. Col. Feyler. (4 Phases —Strategic movement Eastwards from Eski Chehr to the Sangarios—a seven days battle E. of the Sangarios, on the Gkéouk and the Katranzi—after the battle a pause of 10 days—the retreat of the Greek Army on the Eastern bank of the Sangarios.
Col. Feyler considers these operations to be as full of military lessons as that of Kutahia an article on which appeared in the Sept. Revue.)

II. The Reichswehr—its formation and rôle. Maj. de Valliere.

III. Artillery questions. Col. Grosselin.

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GIFTS AND PURCHASES DURING THE MONTH OF NOVEMBER, 1921.

Books Presented.

By The Commandant, Artillery College, Woolwich.

Reports on the Twentieth and Twenty-first Ordnance Courses at the Artillery College. London (Stationery Office) 1921.

Report on the Twenty-seventh Advanced Class at the Artillery College, Woolwich, 21st July, 1921. London (Stationery Office) 1921.

By The Translator.

Adventures in Wars of the Republic and Consulate. By A. Morcau de Jonnes. Translated from the Edition of 1913 by Brig.-Genl. A. J. Abdy, C.B., C.B.E. London (Murray) 1920.

By The Publisher.

The History of the Twentieth (Light) Division. By Capt. V. E. Inglefield. London (Nisbet & Co.) 1921.

By Major A. P. Heneage, D.S.O., R.F.A.

Waffenlehre ein hand und lehrbuch fur Offiziere und Offizieraspiranten. Auf Grund der Kriegserfahrungen. By Major George and Major Erdmann. Berlin (Mittler) 1919.

Die Deutsche Artillerie in den Durchbruchschlachten des Weltkrieges. By Georg Bruchmuller. Berlin (Mittler) 1921.

Der Pionierdienst im Kriege, etc. By Major Toepffer. Berlin (Mittler) 1919.

By Brig.-Genl. W. L. White, C.B., C.M.G., R.A. (Retired).

A Quantity of Books on Mountain Warfare, and Mountain and Pack Artillery.

By H.M. Stationery Office.

Handbooks of the various Countries as under :—

EUROPE.

I.D. 1117. Climate of the Eastern Mediterranean, etc. 1916.
I.D. 1129. Handbook of Turkey in Europe. 1917.
I.D. 1148. Maps of Serbis, Macedonia, etc.
I.D. 1155. Handbook of Bulgaria. 1917.
I.D. 1158. Index of Place-Names in Bulgaria. 1917.
I.D. 1168. Manual of Belgium, and the adjoining Territories. 1918.
I.D. 1204. Handbook of Roumania. 1918.
I.D. 1207. Handbook of Siberia and Arctic Russia, Vol. I. 1918.

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I.D. 1208. Handbook of Finland. 1919.
I.D. 1210. People of Austria-Hungary. I.—Hungary. 1919.
I.D. 1211. Manual of Alsace-Lorraine, with case of Maps. 1919.
I.D. 1214. Handbook of Norway & Sweden. 1920.
C.B. 837. Handbook of Greece. Vol. I. 1918.
I.D. 1114. Handbook of Macedonia, and surrounding Territories. 1916.

ASIA.

I.D. 1118. Handbook of Mesopotamia, Vol. I. 1918.
I.D. 1128. Handbook of Arabia, Vol. I. 1917.
I.D. 1154. Index of Place-Names in Eastern Turkey in Asia. 1917.
I.D. 1162. Handbook of Libya. 1917.
I.D. 1199. Turanians and Pan-Turanianism. 1918.
I.D. 1209. Manual of the Netherlands India. 1918.
I.D. 1215. Handbook of Syria. 1919.

AFRICA.

I.D. 1055. Handbook of German East Africa. 1916.
I.D. 1161. Handbook of Portuguese Nyasaland. 1917.
I.D. 1189. Handbook of Portuguese East Africa. 1918.
I.D. 1213. Manual of Belgian Congo. 1919.
I.D. 1216. Handbook of Kenya Colony & Protectorate. 1920.
I.D. 1217. Handbook of Uganda Protectorate. 1920.

AMERICA.

I.D. 1205. Handbook of Mexico, with case of Maps. 1919.

Books Purchased.

The Riddle of the Rhine. Chemical Strategy in Peace and War. By Victor Lefebure. London (Collins) 1921.

Bartholomew's General Map of Europe showing Bounderies of States according to Treaties.

Experiences of a Dug-Out, 1914-18. By Major-Genl. Sir C. E. Callwell, K.C.B. London (Constable) 1920.

Dictionary of English & German Military Terms.—Ger.—Eng. and Eng.—Ger. 2 Parts. By Capt. C. F. Atkinson. London, (Hugh Rees) 1915-16.

Die Deutsch Kavallerie in Belgien und Frankreich, 1914. By Generalieutnant M. von Poseck. Berlin (Mittler) 1922.

Graf Schlieffen und der Weltkrieg. By Oberlieutnant W. Foerster. Berlin (Mittler) 1921.

Der Marnefeldzug, 1914. By Genl. H. von Kuhl. Berlin (Mittler) 1921.

Die Deutsche Artillerie in den Durchbruchschlachten des Weltkrieges. By Georg Bruchmuller. Berlin (Mittler) 1921.

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REGIMENTAL LIST. The following Postings have occurred during the period 20th October, to 15th November, 1921.

Postings.—R.F.A.

Auld, Lieut. S. C., from India, to R.A. Depôt, India. 19/10/21.
Bloxham, 2nd Lieut. G. C., from 7th Batty., to 4th Batty. 8/11/21.
Brookes, Capt. H. W., M.C., from II. Reserve Bde., to Adjt., II. Res. Bde. 2/11/21.
Brown, Lieut. G. H., from Staff, to I. Res. Bde. 2/11/21.
Burd, Lieut. J. M., from V. Res. Bde., to 108th Batty. 12/10/21.
Burman, Lieut. J. E., from 104th Batty., to 91st Batty. 26/10/21.
Buttemer, Lieut. E. D. A., from H.Q., 30th Bde., to 17th Batty. 26/10/21.
Cherry, Major R. G., M.C., from H.Q., Irish Comd., to Att. IV. Bde. 31/10/21.
Cleeve, Lieut. F. C. F., M.C., from 20th Batty., to Att. Riding Estab, Weedon. 19/10/21.
Clutterbuck, Major L. St. J. R., O.B.E., from IV. Res. Bde., to R.A. Depôt, India. 1/11/21.
Collingwood, Capt. S. G., M.C., from VI. Res. Bde., to 70th Batty. 21/10/21.
Constable, Lieut. J. H., from Staff, to Unposted. 28/9/21.
Cullum, Major E. G. L., from Staff, to 37th Batty. 13/10/21.
Cunningham, Major A. G., D.S.O., M.C., from Staff, to Unposted. 20/10/21.
Custance, Major S. N., from III. Res. Bde., to 13th Batty. 3/11/21.
Danbury, Lieut. J. H., M.C., from Royal Corps of Signals, to 100th Batty. 3/11/21
Dickson, Lieut. A. N., from Staff, to 143rd Batty. 15/10/21.
Graham, Capt. S. D., M.C., from Staff, to 49th Batty. 31/10/21.
Grice-Hutchinson, Major C. B., D.S.O., from 23rd Batty., to 127th Batty. 23/9/21.
Harbord, Capt. (Bt. Major) G. M., M.C., from Rid.-Estab., to I. Res. Bde. 19/10/21
Harman, Capt. A. L., D.S.O., M.C., from Depôt, India, to Adjt., 21st Bde. 31/8/21.
Harrison, Capt. H. T., M.C., from 8th Batty., to II. Res. Bde. 19/10/21.
Heneage, Major A. P., D.S.O., from Staff, to Unposted (G.S. Course). 3/10/21.
Johnson, Major R. H., D.S.O., from India, to 141st Batty. 22/9/21.
Lambert, Lieut. D. E. R. M., from IV. Res. Bde., to 125th Batty. 12/10/21.
Lassetter, Lieut. W. P., from 2nd Bde. R.H.A., to 102nd Batty. 21/10/21.
McGowan, Major T., D.S.O., from 19th Bde., to 135th Batty. 14/10/21.
Martin, Major E. T., D.S.O., from Adjt., III. Res. Bde., to 505th Batty. 27/10/21.
Maturin, Lt.-Col. R. G., D.S.O., from Staff, to Att. 34th Bde. 17/10/21.
O'Beirne, Lieut. J. J., from 9th Batty., to H.Q., 30th Bde. 26/10/21.
Reid, Major (Bt. Lt.-Col.) W. R., D.S.O., from 60th Batty., to 2nd D.A.C. 7/10/21.
Richards, Capt. F. H., D.S.O., from 55th Batty., to 33rd Batty. 3/11/21.
Rowsell, Lieut. S. F., from 17th Batty., to 47th Batty. 26/10/21.
Russell, Lieut. H. E., from "M" Batty. R.H.A., to "G" Batty. R.H.A. 12/11/21.
Strickland, Lieut. W. E., from 102nd Batty. R.F.A., to "K" Batty. R.H.A. 3/11/21.
Tabor, Capt. A. R., M.C., from 34th Bde., to VI. Res. Bde. 7/11/21.
Thompson, Capt. L. F., M.C., from III. Res. Bde., to Adjt., III. Res. Bde. 3/11/21.
Thorburn, Major J. F. P., M.C., from Staff, to 76th Batty. 14/11/21.
Walshe, Major E. U., from II. Res. Bde., to 40th Batty. 2/11/21.
West, Lt.-Col. A. H. D., D.S.O., from 3rd Bde. R.H.A., to 2nd Bde. R.H.A. 17/10/21.
Wickham, Lt.-Col. T. P., D.S.O., from 2nd Bde. R.H.A., to 3rd Bde. R.H.A. 17/10/21.

Cancellation.

Cullum, Major E. G. L., posting from Staff to 37th Batty. R.F.A.
Dudley, A. N. W., posting from 66th Batty., to India.

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R.G.A.—Postings.

Annesley, Lieut. M. T., from 9th Batty., to 14th Batty. 29/9/21.
Atkinson, Major W. H. B., from unposted, to Tees & Tyne. 18/10/21.
Barry, Lieut. E. C. J., from Sierra Leone, to Guernsey. 21/10/21.
Carrigan, Lieut. R. W., from 50th Pack Arty. Batty., to Pack Arty. Training Centre. 1/6/21.
Chuter, Capt. E., from Att. G.H.Q., Ireland, to Adjt. & I.G., Rangoon. 25/10/21.
Davies, Lieut. J. R., from Pack Arty. unposted, to Pack Arty. Training Centre. 13/9/21.
Fawcus, Lieut. C. L. D., from 12th Batty., to 16th Batty. 29/9/21.
Freeland, Capt. K. F., from Staff, to 12th Batty. 29/9/21.
Hamilton, Capt. H. A., from Pack Arty. unposted, to 10th Batty. 29/9/21.
Hanlon, Capt. D. R., from Sierra Leone, to Att. H.Q., Irish Comd. 26/10/21.
Holbrook, Capt. F. G., from N. Irish Coast Defences, to Ceylon. 20/10/21.
Hutchison, Lieut. E. A. O., from "B" Coast Batty., to "A" Coast Batty. 28/10/21.
Kenyon, Major H. E., D.S.O., from 41st Pack Arty. Batty., to Plymouth Coast Def. 31/10/21.
Lawes, Major T. C., from S. Irish Coast Def., to Hong Kong. 7/11/21.
Lay, Capt. J. W., from South Africa, to Singapore. 4/11/21.
Malet, Lieut. G. E. G., from Aden, to 16th Pack Arty. Batty. 20/9/21.
Mayne, Capt. R. C. M., M.C., from Rangoon, to II. Res. Bde. 8/11/21.
Oakley, Lieut. C. V., from 10th Batty., to 13th Batty. 29/9/21.
Pargiter, Capt. (Bt. Maj.) R. B., from Staff, to Unposted. 20/10/21.
Pargiter, Capt. (Bt. Major) R. B., from Unposted, to II. Depôt, R.G.A. 8/11/21.
Patchell, Lieut. F. T., from Sierra Leone, to Portsmouth. 31/10/21.
Pellew, Major V. H. L., M.C., from "J" Coast Batty., to S. Irish Coast Defences. 7/11/21.
Pratt, Major (Bt. Lt.-Col.) E. R., M.C., from IV. Depôt, to "A" Coast Batty. 27/10/21.
Ross, Capt. A. D., from Att. R.A.O.C., to Thames & Medway Defences. 11/11/21.
Rynd, Major F. F., D.S.O., from Staff, to "O" Coast Batty. 24/10/21.
Thompson, Lieut. W. C., from Sierra Leone (unposted), to Milford Haven & Seven. 12/11/21.
Walters-Symons, Lieut. W. E., M.C., from 3rd Bde., to H.Q., 4th Bde. 29/9/21.
Ward, Lieut. L. R., from 46th Pack Arty. Batty., to Pack Arty. Training Centre. 1/10/21.
The notification regarding Captain R. G. Bignell, R.G.A., from D.A.Q.M.G., Aden, to the Unposted List, dated 6th June is cancelled.

Staff Appointments.

Royal Artillery.

Davies, Col. W. P. L., C.M.G., D.S.O., Commandant R.A. 6th Divn. and temp. Lt.-Col. 14/10/21.
Taggart, Lieut. (D.O.) P., Seconded for Inspection and Experimental Staff. 11/3/21.

Royal Horse and Royal Field Artillery.

Archdale, Major A. Q., Bde. Maj., 53rd (Welsh) Division T.A. 31/10/21.
Ayers, Lieut. A. H. R., D.A.D. Remounts, Iraq. 20/9/21.
Clarke, Lieut. W. S., seconded to Tank Corps. 12/10/21.
Fitzgibon, Major F., D.S.O., seconded for Gunnery Staff Course. 29/9/21.
Gage, Lieut. E. H., M.C., A.-D.-C. to G.O.C.-in-C., Aldershot Command. 2/11/21.
Hancocks, Capt. A. C., M.C., seconded for Gunnery Staff Course. 3/10/21.
Heelas, Major P. J. B., D.S.O., seconded for Gunnery Staff Course. 3/10/21.
Jackson, Capt. C. R., seconded to Tank Corps. 10/10/21.
Mason, Lieut. B. G., A.-D.-C. to G.O.C. Troops, Palestine. 1/10/21.
Meysey-Thompson, Lieut. O. V. C., seconded under A.O. 323/1919, for University Course. 8/10/21.
Pery-Knox-Gore, Major I. C., D.S.O., M.C., Brigade Major R.A., Egypt & Palestine. 27/7/21.

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Royal Horse & Royal Field Artillery.—(*Continued*).

Purser, Major A. W., O.B.E., M.C., seconded for Gunnery Staff Course. 8/10/21.
Rawlins, Lieut. S. B., seconded for Colonial Employment. 1/9/21.
Rayson, Lieut. J. H. K., Staff Capt., A.G. 10. War Office. 1/11/21.
Robinson, Capt. W. H., Appointed to I.O. Dept. 20/7/21.
Robertson, Major H. M. M., O.B.E., M.C., Comdr. of Coy. of Gentlemen Cadets, R.M.A. 1/11/21.
Stratton, Lieut. G. L., M.C., G.S.O., 3rd Grade, Army Headquarters, India. 1/8/21.
Tristram, Major G. H., seconded for Gunnery Staff Course. 1/10/21.
Williams, Lieut. S., seconded to Somaliland Camel Corps. 2/9/21.

Royal Garrison Artillery.

Armstrong, Capt. R. A., seconded for Gunnery Staff Course. 8/10/21.
Bell, Capt. L. G. R. F. H., M.C., D.A.A.G., 18th Divn., Iraq. 1/9/21.
Elphinstone-Dalrymple, Major (Bt. Lt.-Col.) Sir F. N., Bt., D.S.O., A.Q.M.G., (from A.A. & Q.M.G.) Vth Divn. 22/8/21.
Gordon, Major W., D.S.O., seconded for Gunnery Staff Course. 8/10/21.
Moore, Capt. H. T., M.C., Staff Capt., 54th Inf. Bde., Iraq. 25/8/21.
Sturges, Major C. H. M., D.S.O., seconded for Gunnery Staff Course. 1/10/21.
Williams, Lieut. H. D., Staff Capt., Aux. Force, West. Comd., India. 20/9/21.
White, Lieut. Harold, Att. G.H.Q., Egypt. 7/7/21.

Promotions. (Non-Regimental).

Livingstone-Learmonth, Bt. Col. J. E. C., C.M.G., D.S.O., to be Colonel, 4/11/21, with seniority 3/6/1918.
Taylor, Lieut. R. W., Temp. Capt. while employed with W.A.F.F. 27/8/21.

To Temporary Half-Pay.

Westell, Capt. (D.O.) C. E., on account of ill health. 2/11/21.

To Half Pay List.

Freeman, Lieut. H., D.C.M. 26/10/21.
Saltwell, Lieut. E. J., M.C., whilst employed on Administrative Service in Nigeria. 21/9/21.
Somerset-Leeke, Lieut. H. E. G. 20/10/21.

Transfers.

Hedley, Lieut. G .H., M.C., from R.F.A., to R.A.S. Corps.

Retirements on Retired Pay.

Anley, Col. W. B., D.S.O., from half-pay, with hon. rank of Brig.-Genl. 29/10/21.
Bicheno, Capt. E. 12/11/21.
Bonham, Lieut. J. E., with rank of Captain. 15/11/21.
Bonney, Capt. J., on account of ill health. 2/11/21.
Bower, Lieut. H. R., M.C., to Temp. retired pay from half-pay list. 28/10/21.
Boyd, Lt.-Col. S. O., from half-pay list. 1/11/21.
Bullen, Col. S. D., D.S.O., from half-pay list. 5/11/21.
Clarke, Lieut. F. J., from half-pay, with rank of Capt. 5/11/21.
Corbett, Lt.-Col. E. F., from half-pay list. 1/11/21.
Corrie, Lt.-Col. G. G. W., from half-pay list. 1/11/21.
Cox, Lieut. F. G. L. 6/11/21.

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Retirements on Retired Pay.—(*Continued*).

Currie, Lt.-Col. I. B. F., D.S.O., from half-pay list. 1/11/21.
Dean, Capt. W. T., M.B.E. 27/10/21.
Disney-Roebuck, Major A. W., from half-pay, on account of ill health. 1/11/21.
Eady, Lt.-Col. C. E., from half-pay list. 1/11/21.
Easton, Col. F. A., D.S.O., from half-pay, with hon. rank of Brig.-Genl. 1/11/21.
Fahey, Lieut. W., from half-pay list. 11/11/21.
Fasson, Col. D. J. M., C.B., C.M.G., on account of ill health, with hon. rank of Brig.-Genl. 29/10/21.
Ford, Major G. T. 1/11/21.
Fowler, Lt.-Col. W. J., from half-pay list. 1/11/21.
Hutley, Capt. H., with rank of Major. 1/11/21.
Lockhart, Lt.-Col. R. N., D.S.O., from half-pay list. 1/11/21.
Martin, Capt. J. F. 7/11/21.
Moultrie, Col. H. C., D.S.O., from half-pay list. 22/10/21.
Murray, Major A. D., D.S.O., with rank of Lt.-Col. 30/10/21.
Muspratt-Williams, Lt.-Col. R. L., from half-pay list. 1/11/21.
Owen, Lt.-Col. C. H. W., C.M.G., D.S.O., from half-pay list. 1/11/21.
Rumbold, Col. W. E., C.M.G., from half-pay list. 1/11/21.
Scott, Lieut. A. C. 3/11/21.
Scott, Lt.-Col. E. B., from half-pay list. 1/11/21.
Shaw, Major G. D. A., D.S.O., from half-pay, on account of ill health caused by wounds. 4/11/21.
Twiss, Col. F. A., C.M.G., D.S.O., M.V.O., from half-pay, with hon. rank of Brig.-Genl.

Retirements with a Gratuity.

Blanchard, Lieut. F. W. 26/10/21.
Graver, Lieut. A. 19/10/21.
Lewis, Lieut. W. 29/10/21.

Resignations.

Hardie, Lieut. A. S. 8/11/21.
Turner, Lieut. S. C., M.C., with rank of Capt. 14/11/21.
Wedderburn-Maxwell, Lieut. H. G., with rank of Capt. 19/10/21.

Cashiered.

Barry, Lieut. T. H., by sentence of a General Court Martial. 20/6/21.

Deaths.

Alexander, Lt.-Col. W. P. (retired pay). 17/10/21.
Owen, Maj.-Genl. C. H. (retired pay).
Ward, Major B. S. 3/10/21.

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"MILITARY INTELLIGENCE AND INCIDENTS CONNECTED THEREWITH DURING THE WAR."

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 15th November, 1921.

BY LIEUT.-GENL. SIR G. M. MACDONOGH, K.C.B., K.C.M.G., (Adjutant-General to the Forces).

General Lord Horne, G.C.B., K.C.M.G., A.D.C. General, Colonel Comdt., R.H.A., in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, Sir George Macdonogh, Adjutant-General to the Forces and for some three years Director of Military Intelligence at the War Office, will lecture to you to-night on Military Intelligence and incidents connected therewith during the war. I am sure you will share with me a very keen interest in hearing what he is able and willing to tell us. I will ask him to begin his lecture.

LT.-GENL. SIR G. M. W. MACDONOGH: Lord Horne, Ladies and Gentlemen: Sir Ian Hamilton, in the book which he has recently published, states that the functions of the General Staff are to sit and think, while those of the Adjutant General are to act. As he does not say that the Adjutant General has to think, the presumption is that he means that, that is not one of his functions.

However that may be, I have had very little time to think of this lecture. When I was on leave last September I meant to revert to my General Staff life and to sit and think about it, but I am afraid that like the man in *Punch* I merely sat, and consequently, when last week end came I found I had prepared nothing. Such thought as I have been able since then to give to my subject has lead me to the conclusion that it is impossible in the short time available to give you anything like a complete account of the Intelligence Service. I, therefore, propose merely to make some discursive remarks strung upon an intelligence string.

I do not propose to suggest to you that it was good intelligence which won the war, but I will suggest to you the reverse proposition, namely, that it was bad intelligence which lost the war, and with your permission, I will make later on a few remarks on the opening phases of the campaign of 1914 with the object of proving that proposition.

The value of a good intelligence service has been appreciated from the earliest times, and the principles on which it has been erected are the same now as they were in the time of Moses. It has always

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been necessary for a commander to be well informed of the nature of the country on which he is about to operate, and of the strength of the armies and of the reserves of his enemy before he can formulate a reasonable strategical plan. You will all remember that Moses sent out from the wilderness of Paran one man from each of the twelve tribes for the purpose of searching the land of Canaan. The instructions which he gave to his intelligence agents were similar to those which would be given at the present day. He told them to reconnoitre the country, he gave the routes which they were to follow, he told them to report about the inhabitants, whether they were weak or strong, whether the population dwelt in tents or in fortified cities, and what supplies of food and fuel were to be found in the country. They obtained all these particulars and the way in which they presented their reports gives us a very important lesson. They did not confine themselves to stating what they had seen, but they drew conclusions, and said that the enemy was far to strong for the Israelites to have any chance of beating them. That was not their job, and their interference in matters with which they were not concerned gave rise to just as great trouble 3,500 years ago as a similar action would to-day. The lesson is that it is the duty of the intelligence agents to collect information, but it is for the commander-in-chief, or rather for his staff officer in charge of intelligence, to draw deductions from it. I shall say nothing more about ancient history, but go straight on to the Great War.

I will venture to say that one of the chief reasons why the Germans lost the war was because they had a bad intelligence service. This service was in charge of a certain Major Nicolai, and it failed from the very outset of the campaign. As far as the eastern front was concerned it grossly overestimated the time that the Russians would require for the mobilisation of their armies, for it led the German higher command to believe that Russia would not be in a position to advance in force into Galicia and East Prussia before the middle of September, and that consequently there would be some six weeks available in which to defeat the enemy on the Western front before it became necessary to turn towards the east. The whole Austro-German plan of campaign was based upon this assumption, and at its outset von Moltke informed Conrad Von Hotzendorf, the Austrian Chief of the Staff, that he considered that the decisive action in the west would be fought about the 39th day after mobilisation, i.e., about the 9th September. I may say parenthetically that this forecast of the operations branch of the German staff was extraordinarily accurate, as the battle of the Marne was being fought on that date, but that battle was lost not won, and one of the main reasons why the Germans lost was that the intelligence branch had failed.

Far from having to wait until the middle of September before advancing, as the Germans had expected, Rennenkampf's army commenced to invade East Prussia on the 18th August, that is, on the same day as the Germans commenced their advance westwards from their positions of concentration on the German-Belgian frontier. A very

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few days later Ivanov's group of four Russian Armies entered Galicia, and on the 25th August battles were in progress along the whole of the Austrian Northern Front, resulting by the middle of September in the withdrawal behind the San of all the Austrian forces.

Intelligence regarding the Western Front was equally faulty. Little or nothing was known of the movements of the British Expeditionary Force. On the 20th August, by which date as you all know four British divisions had not merely landed in France, but had concentrated about Le Cateau and were about to advance on Mons, German G.H.Q. issued a communication that though a British landing had taken place at Boulogne it was believed that a disembarkation had not yet been effected on a large scale. Three days later, when von Kluck arrived before Mons, he was unaware that the British were holding that city, and were drawn up along the Mons-Condé Canal, in fact he had been informed by his cavalry only a few hours previously that there was no enemy within fifty miles of that position. From this it is clear that the German front line or tactical intelligence was as bad as its strategical intelligence. One reason why their strategical intelligence was bad was that the British intelligence authorities had not been asleep, and had arrested all the important German agents in the United Kingdom the moment hostilities were declared. All through the period of the battles of Mons and Le Cateau and for some days subsequently, von Kluck persisted in the belief that the British were based on Boulogne, Calais and Dunkirk, and it was owing to this misapprehension that after the battle of Le Cateau he directed his pursuit south-westwards towards Peronne, in the hope of severing their communications, instead of pressing southwards through St. Quentin on the heels of the retreating British.

The estimate made by the German Intelligence of the effect of the opening battles of the war on the morale and upon the powers of resistance of the Franco-British Armies was as faulty as their knowledge of their movements. Major General von Tappen, who was head of the operations section at German G.H.Q. tells us that on the 25th day of August von Moltke considered that the great decisive battle in the west had been fought and decided in Germany's favour, and that the time had come when forces might be transferred to the Eastern front. The result of this miscalculation was that two corps were actually moved away from the German right wing on the 26th August, and were transferred to East Prussia where they arrived some days after the victory of Tannenberg, that is to say, they were wasted, as they were too late to do any good in East Prussia and they were absent from the battle of the Marne, where their presence might have exercised a decisive influence. Not merely were these two corps actually taken away, but von Moltke intended to transfer eastwards four more corps, but as these corps had to be withdrawn from the front line and important events took place while this was being done, the orders for their departure were cancelled, and they returned to their armies.

An equally grave mistake on the part of the German Intelligence was their failure to appreciate the importance of General Maunoury's

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I should like, however, to warn you against supposing that an intelligence officer ever acts like the heroes of Mr. William Le Queux's novels, or that the Secret Service is the back-bone of intelligence. Sensationalism enters but little into its work. Its results are produced by hard work, great diligence, and untiring watchfulness, and the painstaking collection and collation of every possible form of information. Nothing is too small to be unworthy of the attention of the I.D., and no problem too big for it. Even the most unlikely rumours should be forwarded by intelligence agants to Headquarters, for it is there alone that their worth can be apprized.

I remember one case during the war, when most important information was held back by the officer in charge of a group of agents abroad because he thought it too good to be true—it was true all the same, and if he had transmitted it it might have had an important effect on the issues of the campaign. Do not suppose that I wish you to think that all these rumours should be believed, they are often set about by the enemy for purposes of deception, but even then important deductions may often be made from them. I remember during the latter part of the first battle of Ypres receiving from Lord Kitchener most circumstantial reports of the despatch and arrival of German reinforcements on our front. These reports emanated from Amsterdam and created much alarm and despondency in London when Lord Kitchener communicated them to the Cabinet without having them first properly verified. I well recollect Mr. Asquith coming to my office in St. Omer about this day seven years ago to ask me about them, and my telling him that I felt sure that they had come direct from the Great General Staff, and that their object was to conceal the withdrawal of large masses of German troops from Flanders to Poland, and I was able to assure him from incontrovertible information in my possession that the battle was practically over.

Intelligence personnel may be divided into two main groups, a very large one, which collects information and whose main characteristic is acquisitiveness, and a very small one which extracts the substance from that mass of facts and fiction. The mental requisites of this last class are (1) clearness of thought, (2) grasp of detail, (3) a retentive memory, (4) knowledge of the enemy, (5) the power of projection into his mind, (6) imagination tempered by the strongest common sense, (7) indefatigability, (8) good health, including the absence of nerves, and (9) and above all others, absolute impartiality. A high intelligence officer who allows himself to have any preconceived notions or prejudices is useless. He must look at friend, foe and neutral alike, that is, merely as pieces on the chess board. I remember one of the very best intelligence officers I ever had failing at a critical moment because he had become so imbued with the idea of German efficiency that he was incapable of realising the significance of their great defeat by the British 4th Army at Villers Bretonneux on the 8th August, 1918. I know no quality that is so rare and so valuable as this of impartiality or of keeping an absolutely open mind. Englishmen seem to have a strange facility for identifying themselves with the

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ideas of the extreme nationalist parties of the peoples amongst whom they are living. I remember, when I was D.M.I. the cases of more than one officer attached to the armies of our Allies, whose reports were almost valueless as they would look at everything from the ultra-national standpoint, who could see no fault in the Army to which they were attached and who appeared to be ignorant that there was any theatre except that in which they found themselves.

Speaking broadly and neglecting many important accessories, intelligence may be divided into two main parts—Offensive Intelligence, in which we are attacking the enemy and endeavouring to find out everything concerning him, and defensive intelligence, in which we are doing out utmost to prevent him acquiring information about ourselves. Both of these divisions are equally important, and I regret that time will prevent me from saying anything at all about the latter.

If you were to ask me which is the most important function of the offensive intelligence I should probably surprise you by saying that it is the building up and constant verification of the enemy's order of battle. When we went to Flanders in August, 1914, we knew very little of what reserve units the enemy might bring against us. We knew, of course, of what his regular corps consisted, and that behind them there stood large numbers of Landwehr, Ersatz reservists and Landsturm, but we were very uncertain as to how they would be organised, and what new units, if any, would be formed. If we were uncertain of these points you may imagine how far more uncertain the Germans must have been about our own organisation. It very soon became apparent that there were many units in the field of which we knew nothing, and that we must at once collect every scrap of information that would enable us to construct the enemy order of battle. The advent of the 4 new German corps in the middle of October 1914, made this all the more necessary.

I dislike mentioning the name of any living person, but I think I may be permitted to do so in the case of one who is dead, and to whom I should like to pay the most sincere tribute of affection and admiration. This work of building up the German Order of battle was taken over by the then Captain Edgar Cox, in my opinion one of the most brilliant officers that has ever passed out of the R.M.A. into the Royal Engineers. He combined in an unusual degree an exceptionally quick and accurate brain with an almost tireless body. He used to sit far into the night compiling every shred of information, and it was entirely due to him that in March, 1915, we were able to issue the first edition of the German Forces in the field which shortly became the Vade Mecum of every intelligence officer. From that day on Cox went forward, and I think that Lord Horne will agree with me in saying that when, as the youngest Colonel in the Army, and with the rank of Brigadier General, he went to France in January, 1918, as head of the Intelligence at G.H.Q. his clearness of exposition of the German plans made an almost electrical impression on the Commander-in-Chief and on the army commanders. His untimely death by drowning on the

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26th August, 1918, robbed the British Army of its finest intelligence brain, and myself of a very dear friend.

I find I am now drawing to the end of the time allotted to me, and that I have barely touched on the fringe of my subject. I should have liked to have told you something of the work of the R.F.C. in the early days of the war. They were then a very small and a very gallant band. Many of them including their very brilliant leader, David Henderson, we shall never see again, but they have left an imperishable name behind them. In those early days, as they were so few in number, David Henderson used, whenever possible, to send the pilot or observer to see me after any important reconnaissance. I remember particularly two which they made, and which were of the very first importance. One over Brussels and to the west of it just after the German occupation of that city, when they saw a great force, correctly estimated at a corps, marching along the Brussels-Ninhove road and then turning south-westwards towards Grammont. This was the German II. Corps of the First Army, von Kluck's right flank, which if Sir John French had not wisely fallen back from Mons might have enveloped the B.E.F. Again and even more important was their reconnaissance on 3rd September, 1914. Up till then we had thought the Germans were marching on Paris, but on that day our British aviators saw von Kluck's Army turn to the south-east. I shall never forget myself plotting those reports on the map in my room in Melun, and being stupefied to see great columns stretching across the map through Nanteuil and Betz and La Ferte Milon, marching towards the Marne between Chateau Thierry and Trilport. It was this information which made it possible for Joffre and Gallieni to plan those movements which resulted in the victory of the Marne, the "turning point of the world war", as even German writers call it.

I should like also to tell you of the services of the topographical section, of the super-human efforts which it made, and of its success in supplying the army with maps during the Retreat, of the Survey Section, of the Sound Ranging Section, and of all the numerous developments which flowed from it.

Then there was the Censorship, a most irksome business, but one which obtained information of untold importance to the Nation, besides preventing the leakage of our own secrets. Then there was the Propaganda department, which Ludendorff admits to have produced disastrous results on the morale of the German troops and nation, and which was chiefly the work of the intelligence directorate.

The whole story is one of enthralling interest, but I doubt if it can ever be adequately written. I hope that what I have told you may give you some slight idea of what a vast concern it was, and how great was its importance. I think I may say too, with truth that starting from the humblest beginnings it expanded, thanks to the zeal and talents of its many distinguished workers, some of whom I am glad to see here to-night, into the best intelligence service the world has ever seen.

I fear you may think I want to take credit to myself, that is far from my intention, I was a mere cog in the wheel, but I do want you

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to give all possible credit to all those hundreds, nay, thousands, of workers who made it what it was. I was its father during all but two months of the war, and I am more than proud of my children. Any honours I have gained I owe entirely to them and I thank them from the bottom of my heart for all that they did for the glory of the Empire and the honour of the British name.

General Thwaites: Lord Horne, ladies and gentlemen, after what General Macdonogh has told us about Intelligence during the war I find it very difficult to add any remarks. I can only say as a tribute to Sir George Macdonogh that when I took over his position in the last two months of the war I found the machine running with such extraordinary facility that there was practically nothing for me to do. It was only when the Armistice came and we had to revert to peace conditions that my labours really began. Sir George Macdonogh laid great stress on the question of the order of battle being one of the most important points to watch from an Intelligence point of view. I think that all officers who commanded in the field realize that from the order of battle they can make their plans. When I commanded a division in the First Army under Lord Horne, I remember that the First Army had an insatiable thirst for identification. On that point I want to say that the chief agency for establishing and building up the order of battle is the *troops in the front line*. (Hear, hear.) I want to emphasize that point on account of all the regimental officers I see here to-night; so let me say again that the most important agency in sending in the information for the purpose of building up the order of battle is, first of all, the troops who are actually in contact with the enemy, and secondly, further afield from a strategic point of view, we get the agents either in the occupied territory or in the enemy's territory itself.

The Chairman: Ladies and Gentlemen, my first duty is to add my tribute to the wonderful efficiency that was attained by the Intelligence Department during the war. I watched it grow from the very beginning until it arrived at the wonderful organization of November 1918. I can recall so well the early days when we were ignorant of what units had been formed by the Germans and how it influenced Lord Haig in the very trying times through which he went with the First Corps to which I belonged. Looking at the matter in the light of after experience, one knows that had we had an organization capable of sifting out the data that reached us in those days we should possibly have possessed our souls in much greater peace than we did.

I would like to add my tribute to the memory of General Cox. He helped us very much. He visited commanders and had interviews with Intelligence officers, and had a most excellent effect on the morale of everyone of us. In fact, towards the end of the last year or so, the accuracy with which my own Army Intelligence officer, for instance, was able to piece together what was going on behind the German lines was really wonderful. General Thwaites has referred

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to one's impatience. I admit that if I was not getting a prisoner on any particular front I used to go down and implore the troops to get one, and I found that however difficult it was I never asked in vain. They made a raid and came in with some men. I remember that one used to ask them to bring a man in alive if they possibly could because the German soldier gave excellent information. We never got anything out of the German officer, but the German soldier spoke as openly as possible and gave one wonderful information.

Let me give you one illustration of the importance of identifications. When it was proposed to move the Canadian Corps from the Arras front to take part in the operations on the Somme which commenced on the 8th August, 1918, and it was very desirable indeed that we should, mystify the Germans as to where our counter-attack would commence, it was, thought advisable, to send a battalion of Canadians up to General Plumer's army in the north. We had extraordinary good luck, from the intelligence point of view, when they went into the line up there, because on their very first night in the line the Germans obtained identifications. (Laughter.) It is a fact, is it not?

LT.-GENL. SIR G. M. W. MACDONOGH: Yes.

THE CHAIRMAN: As you know, they attacked on the 8th August down on the Somme. Directly after that they were put into the train and taken to the Arras front, and on the 26th August they attacked at Arras. The German prisoners who were taken then said that they would be hanged if they knew what to make of it—there were Canadians everywhere. It was a really wonderful illustration of what identification properly organized can do.

You will all agree with me, I think, that before the war we were very much brought up to consider that in anything connected with army organization Germany was an example to the world. I can bear out what Sir George Macdonogh referred to—the difficulty of believing how bad the German organization could be, and the difficulty there was in giving them credit for the mistakes they made. That, I think, is a very comforting thought to us, that, to begin with we were not so far behindhand and once we did set to work we organized on a very much better scale and on very much better lines than the Germans, with their great military organization, were capable of.

We are very grateful indeed to Sir George Macdonogh for coming here to-night. If there is a busy man at any time, certainly at the present time, it is the Adjutant General to the Forces, and that he should have given time to the preparation of this lecture for us and to coming here to deliver it to-night is, I think, very kind of him indeed, and I can assure him that we all very highly appreciate it. (Loud applause.)

LT.-GENL. SIR G. M. W. MACDONOGH: Lord Horne, ladies and gentlemen, I thank you very much for your very kind remarks, and for your generous appreciation of my efforts.

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"SPORT."

AN ESSAY.

BY CAPT. D. J. R. RICHARDS, D.S.O., M.C., R.G.A.

"Sport: Its uses and abuses as an adjunct to the training of the soldier."

ANY really reputable military work, or even essay, should lead off with a series of platitudes so painfully obvious that they produce in the reader either a sensation of great wisdom, or the acute desire for sleep. Therefore I make no apology for presenting, "without extra charge," as Mr. Leacock puts it, a first class platitude—that an Army exists mainly for the purpose of fighting when called upon tc do so. Friend Euclid—a man remarkably quick in the uptake—would probably add—*Therefore*, its training should fit it to fight. Unpalatable as this statement may be for those enthusiasts who have hitherto believed that the British Army was got up to enable the umpteenth battery to win the Cup, shield or other trophy for which they are now striving, it is nevertheless an idea that must be kept steadfastly before us in considering the function of sport in the Army.

How far does sport assist in producing, not one or two magnificent compilers of centuries, nor even a really safe pair of backs, but a battalion or a battery composed of better soldiers and better men than any that the enemy can set up over against them? Everyone—bar the *Daily Mail* when discharging its duty of castigating the Government—is agreed that, in spite of the complicated, dangerous, and ill-smelling weapons which the misguided efforts of enthusiastic munitioneers have pushed into the luckless soldier's hands, the ultimate issue depends on the Man. It is fairly obvious that in a battle between two forces, equal in number, provided with similar equipment, and unhampered by the attentions of a too zealous artillery, "A" force being composed entirely of trained athletes would defeat "B" force, specially selected from City financiers with a taste for the good things of this life, and a minimum waist measurement of 45 ins. (That is provided "A" was not equipped with a lunatic as C.-in-C.). I am not suggesting that such a force as "A" is practical politics: between that and actuality are fixed two great C's—the Canteen and the Cookhouse. But the nearer we approach the ideal of "A" force the better will our men be as soldiers from, at any rate, a physical point of view. Mere athletic training, however,—as for instance the ability to do 100 yds. in the even 10 secs.—does not confer the second attribute of superiority in moral. Good moral is held to be essential in many of the better armies, and our sprinter may at a crucial moment elect

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to do his hundred in an S.E. direction, true bearing of enemy being N.W. What the army asks of sport is that it shall do something to help the individual man to stop where he is and do his job, when his own inclination is overpowering in favour of "beating it": and that his action in remaining in a locality which has long ceased to be salubrious shall have in some way a powerfully compelling effect on others to do the same. Individual example is excellent in itself; but unless the spirit we know in games as "team-work" is present, its full value is not realised I seem to have read of a religion which impelled its devotees to cast themselves beneath a ponderous car: yet if I saw a turbaned gentleman about to immolate himself with all outward signs of an extreme unction, beneath the creation of Mr. Aveling and his friend Porter, I should not feel in the least impelled to follow his example: I should rather wonder whether he was quite, quite "all there." In like manner thirty Germans in a mud-hole on the Somme five years ago surrendered, after shooting No. 31 because he wanted to fight on. So far from being fired by his example, they only thought he was a maniac whose mania would be the undoing of them all.

We can then postulate three aims for our "adjunct." First, an actual physical superiority over a given foe. Second (a very valuable second) superior moral, in that each man shall despise his enemy and feel that he and his pals are the better men. Thirdly ("and lastly dear brethren") moral superiority: a capacity to endure, to hold together, to "stick it," that is really superior to that of the enemy. The last two are very easily confused. Long experience has taught us that, without sport, the best cannot be got out of the material that is given us to fashion into our batteries and our battalions; and we are very apt to despise the foreigner in his Chocolate Soldier uniform because he is incapable of stopping with address a small ball projected violently in his direction. But because of this lamentable shortcoming he is not necessarily any the worse soldier. The British recruit comes to us permeated with the insular prejudices and idiosyncrasies of long centuries. He would no more go up to Hobbs and demand a light than the German soldier of 1914 would have dared to ask Hindenburg the time of day. In trying to turn to the best advantage these prejudices let us not forget that in the men of other nations they first of all do not exist, and secondly that they are in some degree replaced and made up for by other characteristics that we ourselves do not possess. It follows that the training that produces the best British soldier does not necessarily produce the best Serbian, Russian or Polish warrior. Therefore while we make use of sport as an aid towards a superior moral, and while we may be gratified that the sporting soldier holds his maladroit enemy in contempt, we must also so dispose our efforts that after actual contact with the enemy that contempt shall be intensified; that the supposed superiority shall turn out a real and apparent superiority.

It is beyond doubt that in the recent worlds war championship the football kickers put up a very good show—I include British, French and Americans: and some very disappointing form was shown by troops entered by certain nations of little renown in the world of sport. But some magnificent fighting was put up by enemy and

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Allied troops who as far as games go could be given a long start and a beating by any British battery team. Evidently something more than a mere interest in sport is required to make it a real help in training: the onlooker must be as far as possible eliminated, and transformed into an active participant. As many men as possible must be encouraged to play, and they must be trained to play the game and to play as teams and not as individuals. Thus, and thus only, shall we get from our sport the two things—physical fitness and team spirit—which in conjunction with a sound military training will enable us to prevail against the dourest and most determined opponent.

Every soldier a player! It sounds so easy and it is in reality the most difficult and complex problem. A drunken man who had wandered on to a golf course said he had been into a land of pitfalls inhabited by a horrible Bogey. In this question of sport for the soldier, there are innumerable pitfalls and not one but several very unpleasant Bogeys that must be overcome. The Competition Bogey is the first of these. How often does the entire attention of a Battalion or a Brigade centre on the Battalion or Brigade team—eleven players with scarcely two or three reserves. A side may make a spendid show in a competition, and yet the only people who ever get a game in that unit are the members of the team. Clearly it is hopeless to get enthusiasm without rivalry and without competitions, but I question whether to a large extent they are not begun much too high up the scale. If for example we could concentrate on the smallest possible unit for sport, the platoon or the section, and represent our battalions and brigades by the champion platoon or section team, it would lower the standard of the game itself in the army, but it would spread the net of sport far wider and introduce to regular team-play men who are ready enough to kick a ball about but feel too conscious of their inferiority to expose themselves in an actual game to the scathing comments of the still poorer players on the touch line. As a general rule the average soldier won't play if he thinks he is outclassed. And I would if possible go a step further, and insist that each small unit like a platoon, should produce two teams: that competitions inside units should be on the 1st and 2nd XI. basis, with an equal degree of encouragement to both; and that a battalion should be represented by the XI. of its best platoon; a plan of scoring points for the two teams on a good basis should not be difficult to devise (the two-team system could hardly be applied to cricket, which is a slow game and more exacting in its requirements as to a ground). Any such plan would bring down the standard of games in the army with a crash: but from a purely military point of view that would be no harm. After the Armistice the standard of army football rose to dizzy heights; units discovered that they possessed professionals of considerable repute, and teams of a formidable calibre appeared in the field representing battalions, R.A. brigades, and even batteries. But the ordinary Tommy, though a heated partisan of his side felt a little outclassed by all this brilliance. He—and his section commander too—felt rather fools alongside the XYZ Rovers centre-half. The possession of a really fine player led to questionable expedients being adopted to retain his services. Finally,

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it being a British characteristic that the best players control the game, that control slipped gradually from the officers hands, and scenes that had hitherto been unknown occurred with unpleasant frequency. All of which goes to show that a lowering of the standard of games is not in itself the terrible evil that it may appear. The one fear as that it may discourage the high-class player, particularly the officer, from participating enough in the mens games. And here I come to the second Bogey—the Games Officer. He was born of necessity during the war and threatens to have a prolonged existence. When the war first started there was a kind of feeling that seemed to come from above that if one played cricket, football, or hockey, the Boche would probably find out about it by his amazing system of waiter-espionage and win the war while we were not looking. Later it became clear that some form of relaxation was essential. But the pre-war senior subaltern who used not only to bring up the other subalterns in the way they should go, but who was eminently fitted to supervise the sporting education of the men had been promoted—and in his stead were enthusiastic civilians who had no experience of army ways. Hence the fittest man available was selected for the job of sports or games officer, and well he did it. But the existence of the job in peace is an anachronism. Every officer, from the C.O. downwards, is the sports officer in peace; and the existence of a games officer is unnecessary and serves as an excuse for others to leave it to him and be about their own business. Here lies the whole key to the success of Army sport as a useful function of the Army training. No Board of Control, no expenditure of money, can produce anything beyond the hackneyed institution of eleven men playing for a thousand, unless the individual officer realises that he is the man who is responsible. If he is a good player, his possibilities are infinite. If he is a bad player he can at least encourage other bad players to try, by his example, and by his forethought and care see that his team sets out to the best possible advantage. The officer *is* (or should be) the man on whom all depends. The fact that to-day so many officers in the junior ranks are married constitutes an additional difficulty, and success can only come from the married officer realizing that his job does not end with the last sound of the "Dismiss." The soldier is a queer bird. Nothing will stop the really keen player from playing, but the greatest tact and skilful encouragement are necessary to get the others into the field, and undoubtedly the captain and the subaltern are best able to do this.

There is yet a third Bogey, and a very ugly one, that is met with in Army Sport, and he must be exorcised completely if he is not to miss everything. His name is the spirit of What-can-I-get-out-of-it? If sport is to be worth anything to the army it must help to build up that marvellous moral that enables an army to achieve the impossible. This moral and the thing called self sacrifice are so closely allied that their resemblance need not be insisted on. But self sacrifice and What-can-I-get-out-of-it? are as wide apart as the poles. I heard of a case of a unit in which the idea of a sports meeting with the usual prizes out of the Brigade funds was mooted. The C.O. on being approached was quite willing, but wished the feeling in the unit to be tested first, and a conference of the men was held. The

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attendance appeared small but quite representative and was unanimous in its desire for the sports. These were duly held—and every single event was won by some one or other of the men that attended the conference. Besides this select band there were hardly any competitors. It gave the organisers furiously to think. Nor is it pleasing to overhear one of the reputedly keenest men in the unit loudly declaiming that such-and-such a game is not worth playing "because you don't get let off anything for it," whereas in A, B, or C unit the team gets off this, that and the other." Here we touch the whole problem of what should or should not be done to facilitate sport. I am inclined to think that in the past far too wide differences have existed in the practice of various units. There is all the difference in the world between intelligent arrangement of duties to facilitate games, and letting a man off a duty or a parade to enable him to play or to practice. As an example of the first, if on the occasion of the match with the Blankshires, Unit H.Qrs. have detailed Lt. Jones, their best bat, as a member of a D.C.M. with 10 witnesses, and Lt. Robinson who is short sighted and hates cricket for a second D.C.M. the following day, when R— and J— would have gladly exchanged duties, well the Blankshires deserve to win. Their opponents simply have not the intelligence to do so. Exactly the same principal applies with the N.C.O's and men. But no man should be excused a duty to play games if thereby an extra duty is thrown on another man; or if the games player obtains an advantage over his fellows. This principle should be rigidly enforced if need be, by higher authority in all units alike. Tommy's sense of fair play is devoloped to a most exceptional degree. It does a sport or a game no good if inside a unit the non-players are grousing that they are stuck with the duties of the players. Nor does it do the game any good if the men of A Brigade see the men of B Brigade let off parades to practise for the same event that they themselves are entered for but for which they have to practice in their own time. In this matter the principle is clear: treat all alike and the duty-dodger will disappear in company with—I was going to say the grouser, but as he is an institution we can only hope for the demise of one of his grouses. The application of the principle is not so easy, the temptation where competition is keen being sometimes more than a C.O., who is human, can resist. In this matter Authority—if armed with intimate knowledge—in the shape of the G.O.C., who will obviously be above suspicion of partiality, might very usefully step in. Obviously we can never eliminate self interest from such things as foot races etc., and I believe that in the present state of human nature the best that can be done is to increase the proportion of the events in which success depends on team-work. The elimination of inequitable privileges is a matter of far greater importance.

Thus far I have attempted to postulate what sport is expected to achieve for our army: and to indicate some of the more formidable obstacles to its success. But with the overthrow of these obstacles we should only have achieved this much—that we should have improved considerably the sport that already exists. If we are to succeed in destroying the eleven players and nine hundred

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and eighty-nine watchers system, we must create in our men the desire to play games and to play in teams. There is an old proverb about a horse and water. But have we in the past set about the problem of making our horse drink in the best way. If Gunner Brown, an old soldier, known as a good footballer and cricketer, embarked for the Mediterranean, grasping hands endeavoured to secure him for Eastern, Western, or Southern: but there was no such demand for the youngsters who stared wide-eyed from the troop-ship at the dismal looking spot where they were to have their first real experience of soldiering. I am not disparaging Gr. Brown. He is a splendid fellow and is as keen as mustard. It was probably one of the Gunner Browns' that you saw in the shady row of trees as you came into Arras, slinging a dilapidated cricket ball at three improvised stumps. It was Pte. Brown of the Blankshires that, first of all the shreds of the battalion torn to pieces in the horror of the Somme, unearthed a football and a pal or two, and kicked it round the dreary fields of Meanlte. He has set up his own device wherever he has been in the four and a half long years that are past, and the tribesman and the Belgian peasant, the African savage and the dwellers in Mumansk still wonder at the Army that left no trail of frightfulness but only two poles stuck in the ground with a third across their tops. Brown is a type we shall always get—a sportman born who will have his sport: but he is in a small minority. The vast bulk of our recruits are boys of a class to whom *organised* games have been hitherto unknown—raw, awkward and uneducated. Have we not rather concentrated in the past on the finished product? and left the raw material to its own devices, until the majority of it abandoned practical sport for the canteen, while only those in whom the love of games and the determination to take part in them was innate have eventually won through to the Battery team. Some units are guiltless on this score, but the Regimental competition system rendered it difficult to act differently. How could one concentrate on the raw material? Unending defeat confronted a unit that adopted such a system. But given the adoption of a smallest unit basis for all competitions, and given a more or less satisfactory two-team system of scoring, the incentive is provided forthwith. Success would demand a playing percentage of forty instead of four or five, and as not very much can be done with the old soldier who does not play games we should have to turn to the young soldier. I would put forward two suggestions as to how this should be done. First, let the net of sport be spread as widely as possible. The boy who will never play football or cricket may turn out a good oarsman or runner, given the chance and the encouragement: the soldier who will never be much good at any of these may yet become a good boxer. And, while at home sport is mainly limited to these games and hockey, foreign stations may provide swimming and water polo, and local forms of sport of which every advantage should be taken. Let us make every effort to find out the natural abilities of the young soldier and to encourage him to make use of them. And it is for this task that I would make my second suggestion. There are many officers—and there will be many officers too—who are naturally bril-

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liant at games, and occupy high positions in the world of sport. If they can be persuaded to give up some of their time towards helping, training and encouraging the younger soldiers the effect will be enormous. Ian Hay has pointed out, in one of his books, a peculiar trait of the young of the British race—that the doing of a thing easily, without apparent effort, makes a spontaneous and irresistible appeal to a boy's imagination, far more so than does any success achieved as a result of patient study. The example and encouragement of good players are enormously effective in arousing the desire to play games themselves in the minds of young fellows who have hitherto only watched. To get the older man interested is rather the task of the less brilliant, if it is possible at all, as he is easily disheartened if he thinks the company too good for him, and no wonder, for he hates making a fool of himself. Sometimes we can hardly admire some of the methods employed by certain men. Public schools for instance have never encouraged wicket-keepers to assist the fall of the bails with their pads. But we must be patient as well as firm: remembering that, especially in the case of youngsters, such devices may well have been held up to them as smartness in the past.

In conclusion it is worth while noting the deep impression made upon the French authorities by the part that sport plays in the training of our army. So much so, that strenuous efforts are being made to introduce more and more games into the life of the French soldier; and this too in an army intolerant of the useless, and skilful to the utmost in economising effort. In an army too, where an officer who regularly appear in flannels is still looked on by certain of his fellows with tolerant disdain, as a child who has failed to grow up. Does the case for sport stand in need of further proof? I think that, to achieve success,our friends and Allies will find that it is not quite enough to say "There shall be sport in the Army": but that a good deal more in the way of providing facilities has yet to be done. We are not likely to fail in this respect, but we should at the same time keep constantly before us, as the French do, the fact that training is the main object and sport and games are accessories. If we can render army life enjoyable even in not too pleasant stations; if we can get a large proportion of our men in excellent physical condition; if we can inspire them with a fine pride in their Unit; if we can teach them team-work and emulation in efficiency whether on the gun or in the playing field, then we can say that our accessory has indeed served us well.

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SOLDIERING UNDER JOHN COMPANY.—III.

An Officer in the Madras Artillery, 1779-1820.

[BY ONE OF HIS GRAND-DAUGHTERS.]

Reprinted from "The Pioneer Mail," July, 1921.

THE return voyage of Major Bell to India, was in every way agreeable, broken by a short stay at Maderia where the Major purchased six pipes of the island wine, and ordered two to be sent him yearly to India. By family tradition he drank a bottle every day at tiffin, and then played it off at tennis, which would well account for his gout in after life. Theatricals enlivened the long voyage, and the frequent result of so many week's intimacy on board ship followed in the engagement of Captain Richardson to one Miss Scott, and the attachment of Major Bell to her sister, which he prudently waited to declare until they should land.

On their arrival in Madras Roads, his nephew, Ben Sydenham, A.-D.-C. to Lord Wellesley, came on board with the news "that a large army had assembled and were in forward preparation for marching into the Mysore." And, on delivering in person some despatches he had brought out to Lord Wellesley—who was much aggrieved at not receiving some treasure he expected at the same time—"he very plainly made known that the sooner I could join the army the better pleased he should be, as the services even of an individual were desirable. My equipment for camp was made with despatch. Horses, bullocks, camels, and palankeen, etc., procured with difficulty, and I left at night to join the Army under Lieutenant-General Harris, destined for the conquest of the Mysore. Next morning, hearing a noise of voices at daybreak, I opened the door of the palankeen and, at a distance of about 150 yards, saw a large tiger very deliberately trotting off without molesting any of the numerous travellers nearer to him that I was—so I presume he had supped heartily."

FIGHTING AGAIN.

"Joining the army encamped and ready to advance, I was posted to the right wing of the heavy park, and had the delightful charge of getting forward 22 pieces of the battering train, which on one day could only proceed 3 miles, occasioned (*sic*) by a deep, heavy, long, dry bed

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of a river. The bullocks were of little use in this situation. Manual strength only, with the aid of elephants, could get the heavy ordnance through."

"The operations of the siege of Seringapatam I do not attempt to detail. My observations are purely personal. On the 4th May, 1799, I commanded the breaching battery and with 100 artillery men and a proportion of officers joined the storming party. In ascending the breach I was twice struck by nearly spent balls, one wounding my empty sword scabbard, which otherwise might have entered my thigh. I was present when Major Allen brought Tippoo's sons to General Baird from the palace, where a guard was posted for its protection. A person of rank attached to Tippoo's person assured General Baird that Tippoo's body was amongst the slain in the gateway of the inner fort, having been taken from a large heap of dead where this person pointed it out. The body was placed in an army dooly and put down in the palace yard close to the treasury" (where no doubt it was rifled.) "The interment took place next day. During the funeral procession my party fired from the walls of his own capital 53 minute guns, so ended my troubles with Tippoo Sultan who, from the hour of my joining the army, was the cause of much harassing fatigue to me."

HIS SECOND MARRIAGE.

Tippoo thus finally disposed of, the Major sought, and obtained leave, to set forth on "my matrimonial campaign," which ended as successfully in his marriage on the 15th December, 1799, to Miss Jemima Scott from the house of her brother-in-law, Captain Richardson, at Calcutta, whence the happy pair proceeded to St. Thomas' Mount, where they remained in peace for nearly a year until, in December, 1880, Major Bell was "ordered on foreign service, under the command of the Hon. A. Wellesley with my company of 102 men." These formed part of the expedition sent from India under General Baird to oppose the French in Egypt. From Bombay, therefore, they sailed into the Red Sea, where their ship, the "Rockingham," struck on a rock, not marked in any chart, and, though she soon got off again, a considerable leak, 7 feet of water in the hold, could not be reduced by incessant pumping. The 200 gun Lascars and Native Pioneers were of little use at the pumps, which were kept going night and day by the European artillery men and officers, "until they reached Jeddah, where Major Bell and his detachment transhipped to the 'Ku Kisseroo' which landed them at Cosseir "without a single sick European."

SERVICE IN EGYPT.

From Cosseir the corps was to follow General Baird's route, and march across the desert to the Nile, where the Indian army was encamped in brigades at the Rhoda island near Cairo. The discomfort of such a march was greatly increased by scarcity of water.

"From the length of time that the musacks, or leathern water bags carried on camels, had been on boat the transports they were in general unfit to hold water. The water found by digging was scarce

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and bad, sour, bitter and stinking. For three or four days all who tasted it, and there was none other, were affected by dysentery. Bad as the water was it was necessary to husband it with care, for, with the exception of a small spring 40 miles in the desert called the New Well, no water could be procured before reaching Logatta within two marches of the Nile. My detachment manned 8 guns, 6-pounders, drawn by well-trained bullocks from Bombay and Surat and crossed from Cosseir to Genna in eight marches, at the rate of nearly 16 miles per day. I obtained permission for my detachment to precede the regiment the latter part of the march—and sent back a supply of water in my own bags, which the Corps gratefully acknowledged was most timely. I had advantages for preserving my musacks by placing them when taken off the camels on trusses of hay, the provender for the bullocks, by which means the leakage was trifling and the bags preserved. My detachment crossed without any anxiety, although night marching in the desert is in my opinion dangerous. Europeans will not sleep in the day, are very drowsy in a slow night march, apt to lie down during a momentary halt a few paces from the line, and on awaking know not how to follow the line, there being no track to guide them."

VOYAGE DOWN THE NILE.

"After a pleasant voyage down the Nile my detachment joined the headquarters of the Indian Army on the island of Rhoda, and I was appointed commandant of a very efficient Artillery Corps. On the arrival of the Indian army at Rosetta we learned that the French army had capitulated and was then embarking for France."

He adds with legitimate professional pride :

"The camp of the Indian army at Rosetta was visited by many officers from the Britiesh Army, from Alexandria, who expressed much satisfaction at the appearance of the troops, and the system of discipline and etiquette observed on all the camp duties. The appearance of the Grenadier Battalion of Bengal sepoys attracted general attention, for a finer corps of men did not exist. This corps was founded by Grenadier Companies from different battalions, and few, if any, of the men were under 6 feet high."

His only comment on Egyptian customs is this : "On my division of boats one morning bringing to for supply of provisions, just as I stepped on shore I witnessed the summary despatch of Turkish justice in the execution of an Albanian, who had on the previous night committed a robbery. The culprit was placed on his knees, and with the stroke of a scimitar the head was severed from the body."

RETURN TO INDIA.

"On the cessation of hostilities, I obtained permission to return to India with Colonel Cupar, having despatches to the Governor-General. We crossed from Cairo to Suez on camels, in—I think—39 hours. We slept on the ground and had comfortable meals, but the slow motion of the camel is very fatiguing. There was no cruiser at Suez, but we learned that we might probably find one at Tor, where

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we proceeded in an open boat, keeping watch alternately to prevent the boatmen pulling into shore, as they did not like night work. At Tor we found the cruiser "Teignmouth" which landed us at Bombay on the 4th December, 1800."

"I had been absent from my wife upwards of a year and not received letters from India for several months, so it was not until I reached Seringapatam through the Coorg country that I learned from my friend Captain Freese that some months before, on the 4th August, my wife had brought me a daughter. I reached my home at St. Thomas' Mount on the 15th January, 1801, where no intelligence had been received of my return, and found my wife and daughter, certainly a most interesting and amiable infant, both well."

Here the memoir ends with a brief notice of his "extraordinary rapid promotion to Lieutenant-Colonel" in 1802, and the remainder of his service in India seems to offer nothing of public interest.

The spelling of Indian names and words is left unaltered.

(*MISS*) *H. M. POYNTER.*

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THE MEAN POINT OF IMPACT.

A Mathematical Note concerning Capt. D. R. D. Fisher's "Proportional" Method.

BY F. R. W. HUNT, M.A., CANTAB.,

Assistant Professor of Mathematics and Gunnery, Artillery College, Woolwich.

IN a recent article[1] Capt. D. R. D. Fisher, D.S.O., R.F.A., outlines an approximate method of determining the mean point of impact of a group of rounds which is based upon the number of rounds observed to fall short of, or beyond, a given target.

The method, briefly, is as follows :—

Let there be p rounds observed to fall beyond the target, and q rounds observed to fall short of the target.

Then the distance of the mean point of impact from the target is given (approximately) by the expression

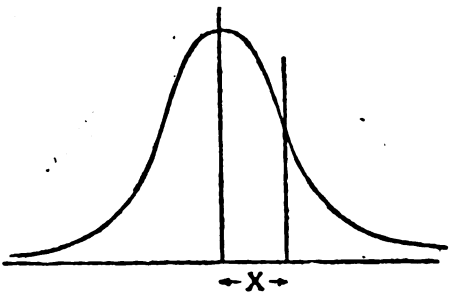
$$\frac{p-q}{p+q} \times 2\rho$$

where 2ρ = width of the 50% zone.

The chief condition imposed by the author is that not less than one-fifth of the group must be short of, or beyond, the target; that is, p and q must not be less than $\frac{1}{5}(p+q)$.

In the following pages it is proposed to investigate this method on the assumption that the fall of rounds is subject to Gauss's Normal Law of Error, and to consider to what theoretical limitations the method is subject.

2. Let X be the distance of the mean point of impact short of the target and let $y = \frac{h}{\sqrt{\pi}} e^{-h^2x^2}$ be the Gaussian for the group.



[1] *Gambling and Groups* by Capt. D. R. D. Fisher, D.S.O., R.F.A., Journal of the Royal Artillery, June, 1921.

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The probability of a round falling beyond the target is

$$\int_{X}^{\infty} y\,dx \text{ and this should be equal to } \frac{p}{p+q}$$

Similarly,
$$\int_{-\infty}^{X} y\,dx = \frac{q}{p+q}$$

Hence
$$\frac{p-q}{p+q} = 2\int_{0}^{X} y\,dx = 2\bar{y}X \qquad \text{where } \bar{y} = \frac{\lambda h}{\sqrt{\pi}},$$

$$\text{and } \lambda = \frac{1}{X}\int_{0}^{X} e^{-h^2x^2}\,dx\ , \text{ a fraction.}$$

$$\text{But } 2\rho = \frac{1{\cdot}69}{h\sqrt{\pi}}$$

$$\text{Therefore } \frac{p-q}{p+q} = \frac{2\lambda\times 1{\cdot}69}{\pi\times 2\rho}X \text{ and } X = \frac{\pi}{3{\cdot}38\lambda}\cdot\frac{p-q}{p+q}\cdot 2\rho$$

Hence, when $\frac{\pi}{3{\cdot}38\lambda}$ is approximately unity,

$$X = \frac{p-q}{p+q}\,.2\rho \text{ approximately} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{I}$$

The conditions for which this holds are seen to be :—

(1) That $(p + q)$ must be a reasonably large number.

(2) That $\lambda = \frac{\pi}{3{\cdot}38}$ approximately.

3. *We must therefore discuss* λ.

$$\text{We have } \lambda = \frac{1}{X}\int_{0}^{X} e^{-h^2x^2}dx$$

$$\text{Hence } \lambda = \frac{\pi}{1{\cdot}69}\times\frac{\rho}{X}\times\frac{1}{100}\,f^{-1}\left(\frac{X}{\rho}\right) \text{ in the notation}$$

of p. 163 of the Text Book of Gunnery, Part I.

When $X = 0$, $\lambda = 1$.

When $X = \rho$, $\lambda = \frac{\pi}{3{\cdot}38} = 0{\cdot}93$ and the formula I holds exactly.

When $X = 2\rho$, $\lambda = 0{\cdot}77$ and, when X is greater than 2ρ, λ is still less.

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A calculation based on I when $X = 2\rho$ thus gives an error of over 20%. This is probably too large.

If we limit the error involved in I to 10%, λ must not be less than 0·84. The corresponding value of X is $1{\cdot}6\rho$.

Hence, provided the *true* value of X is $< 1{\cdot}6\rho$, that is, provided the distance of the M.P.I. from the target is not greater than four-fifths of the width of the 50% zone, the approximate formula I gives an error of $<10\%$.

4. *Limitations of p and q.*

From the condition expressed at the end of the last section we can deduce the limitations of p and q.

Let us write X_1 for the approximate value given by I, so that

$$X_1 = \frac{p-q}{p+q}.2\rho$$

and retain X to denote the true distance of M.P.I. from target.

$$\text{Then } X = \frac{\pi}{3{\cdot}38\lambda} X_1$$

and when $\lambda > 0{\cdot}84$,

$$X < 1{\cdot}1 \times X_1$$

But $X < 1{\cdot}6\rho$,

Hence the condition $1{\cdot}6\rho > 1{\cdot}1 \times \frac{p-q}{p+q}.2\rho$ is sufficient.

$$\text{Hence } \frac{p-q}{p+q} < 0{\cdot}73$$

Whence we see that both p and q must be $> 0{\cdot}13\ (p + q)$.

Hence the approximate formula I will give the distance of the M.P.I. from the target to within 10% provided that neither p nor q is less than 13% of the rounds fired.

This is true, of course, when $(p + q)$ is reasonably large. When the group consists of only a few rounds, the limit for p or q must be raised, since there is an error involved in the fact that $\frac{p}{p+q}$ and $\frac{q}{p+q}$ may not represent the probabilities of "overs" and "shorts" accurately. Capt. Fisher's condition that p and q must not be less than $\frac{1}{5}(p + q)$ is thus reasonably safe.

5. *Variation of* X_1 *with* X.

In conclusion we will consider the variation of the approximate value X_1 with the true value X.

When $\frac{p}{p+q}$ and $\frac{q}{p+q}$ may be taken to represent the probabilities accurately the following table gives the ratio of

$$\frac{X}{X_1} = \frac{\pi}{3{\cdot}38\lambda}$$

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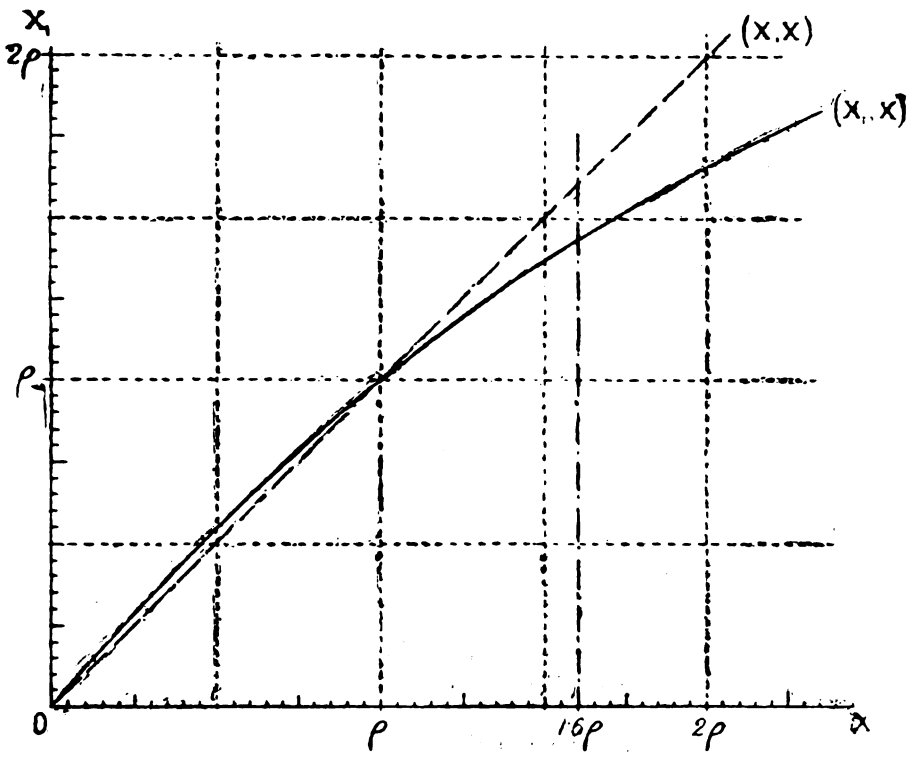
X	X/X_1
0	·93
$\frac{1}{4}\rho$	·93
$\frac{1}{2}\rho$	·94
$\frac{3}{4}\rho$	·97
ρ	1·00
$\frac{5}{4}\rho$	1·04
$\frac{3}{2}\rho$	1·09
1.6ρ	1·10

and the following graph exhibits the variations of X_1 against X.



The curve of X_1, i.e. the distance of the M.P.I. from the target, obtained by using Capt. Fisher's approximate formula, closely approximates to the straight line representing X, the true distance of the M.P.I. from the target, for values of X between 0 and ρ (half the width of the 50% zone). Beyond this value the curve diverges rapidly, and, for values greater than $1{\cdot}6\rho$, i.e. four-fifths of the width of the 50% zone, X_1 involves an error greater than 10%.

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SCREEN TRAINING.

A suggested use for the Army Cinematograph.

BY CAPT. F. C. A. TROUP, R.G.A.

1. It's Educational Value.

THE wide popularity of the cinema and the history of its rapid development suggests the possibility of a wider future for it as a factor in Army training. From a commercial standpoint the cinema need never fear the competition of the stage or lecture room because of the fact that its influence is far more widely based. Its relative independence of time and distance makes it the ideal weapon of propaganda. The book alone is its serious rival but loses ground to it in that the written word rarely achieves the same clear cut impression on the brain that is registered by direct vision. Books are, at the best a very dull artificial and unsatisfactory substitute for reality; the camera, on the other hand presents things as they are and eliminates part of the difficulty of clothing things in words.

The word "Propaganda", is not new but its use as a synonym for "education" on a large scale is fairly modern; it carries the suggestion of a taint, unfairly so, since what stinks is propaganda founded on lies. Propaganda is a feature in the education vote of all States, and in certain forms is a characteristic of Army education which bases itself on that of the nation, and hence it is not unreasonable to claim a future for the cinema in this connection.

2. The Practical Application.

Training aims at the development of the mental, moral, and physical qualities of the individual and at the inculcation of the best methods of co-operation in the mass. Can the cinema help in this? The Somme film showed its possibilities as a graphic recorder of events and as a patriotic influence. But can it do even more that the Somme film achieved?

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It is not to be expected that anyone will gain greatly by watching a squad doing physical jerks or the slope arms by numbers on the screen, nor will a recruit become a layer merely by watching a film demonstration. Roughriders cannot be conjured up out of, say, "Uppish Uriah of Utah." Individual efficiency is, of course, a matter of actual doing for oneself. But, when we leave the sphere of brute force and the mechanical on the one hand and that of mere assertion on the other, and find ourselves in the realm of imagination, it is here that the cinema will help us most of all.

Take for example's sake the Platoon Training Diagrams. Suppose that in them the statuesque platoon commander and his satellites with the Stokes that never goes off were to be galvanized into activity by the magic wand of the cinema, and that the drama of the Soft Spot were to be really enacted; would the doctrine require so much explanation? Surely the Soft Spot film would be an improvement on the Soft Spot picture? The difficulties of producing such a film do not appear to be excessive.

3. Gunnery and the Screen.

Gunners make great use of the miniature range to teach gunnery principles. Even with the limited properties available (often only half a brick and a palpably supported fid of cotton wool) the imagination pulls us through and we learn something. But if the principles underlying the somewhat Shakespearian simplicity of this mise-en-scene were to be accentuated by a faithful reproduction of the Reality which lies behind them, would not the value of the lesson be immeasureably enhanced? Yet the cinema can give us exactly this lesson.

Let us take a concrete case.

Film records of a shoot by any calibre can be obtained from the point of view of the officer controlling the shoot of O or B and we can see the translation of the actual orders into live ammunition at T. A few rounds will serve to educate hundreds instead of the few concerned in the actual practice. Hundreds can put themselves in the position of X, retrospectively and though they cannot influence the fall of shell they can at any rate observe them and form their opinion on the results just as if they had been actual spectators of the practice. Those who fail to spot the exact moment when X went Nap on his range and fuze will be enlightened by the screened remarks of the inspecting officer—censored if necessary.

We could have a file of shoot-films for every terrain and every calibre. The scene could change from Mespot to Dartmoor from the coast to Kiplings "Horns of the Morning" (pace the author of a recent article in the "Journal" who prophesies the disappearance of guns from these airy surroundings). A little extra stage management by the gunnery staff with an eye to effect would give us the maximum educational value of limited practice allotments.

The arrangement of a shoot scenario seems to be fairly simple.

When necessary the operator is dug in at comfortable camera

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range and records the T end. The film is then arranged in sequence of action and screen notices. Before production an instructor gives a short verbal introduction explaining the conditions. The original shooting orders are given, everyone gets ready to observe and lights are downed. The shoot is shown, officers form their impressions: then lights up and a conference. The presentation of OT shoots by the bigger calibres would seem to be particularly favoured by some such procedure.

4. Has the Cinema a Wider Scope?

So much for technicalities. But could not the same principles be applied to illustrate the practical details of co-operation of all kinds? Would it not be feasible to screen the co-operation of tanks with the other arms, or the demonstrations of experimental brigades?

Every training manual might have its own film series which would help to solve the problems that lead to such insistent calls for the attachment of officers to arms of the Service other than their own.

It would be absurd to claim too much for a matter of make believe without a severe practical trial and the clear definition of what is possible based on practical working. But while we still have text-books and lectures it seems illogical to fail to exploit all that the cinema puts at our disposal to help make their subject matter live.

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BOMBARDMENT OF THE HARTLEPOOLS.

16th December, 1914.

BY COL. L. ROBSON, C.M.G., D.S.O., V.D., T.D.

I. INTRODUCTION.

REPORTS of the Action at Hartlepool between 3 German Warships and the Shore Batteries, were rendered, at the time to the War Office. The narrative of the action was called for by the Military Authorities in June 1921. Attached is also an interesting report by Skipper Horsley. Since this narrative was written I have read Mr. Filson Young's book "With the Battle Cruisers" in which there is a chapter describing the Raids on the north-east coast, which I have criticised in "Notes."

It is an interesting fact that this is the second recorded artillery action at Hartlepool, I quote from the publication of the "Surtees Society." "In 1650 an Irish Frigate boarded a Newcastle Ship near Hartlepool, which, the Governor seeing caused some of his guns to be so planted that they shot the Irish Frigate through and through and caused her to hasten away and leave her prize which came safe into Hartlepool."

In those days the Prince Bishop of Durham collected the shipping dues at Hartlepool and would, no doubt, have had up-to-date Batteries for the Defence of the Port.

The artillery defences at Hartlepool can be traced back for over 300 years, and the present Durham R.G.A. are the lineal descendents of those ancient Gunners who manned the local Batteries. I have a list of the officers of "The Hartlepool Volunteer Artillery in 1803," all Gentlemen of the district.

The Personnel, Officers and men of the manning details furnished by the Durham R.G.A. in 1914 belonged to the Hartlepools, many of them living close to the Batteries. As Fire Commander owing to interrupted communication I had little to do during the action, but had the satisfaction of having personally trained the Fire Command.

One of the principal lessons from this engagement is that Fire Commanders and their communications should frequently be made, casualties during gun practice and that the Battery Commanders should 'carry on' by means of 'standing orders.'

II. NARRATIVE.

8 a.m. Weather conditions, hazy, with a bank of fog lying about 4,000 yards off Hough Battery and parallel with coast line. At 12 o'clock (midnght) 15th and 16th a message was received by the Fire Commander that a German Squadron was in the North Sea and to

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expect attack. As the Works of Defence were always manned one hour before daybreak this message did not perturb us at all. At 8.5 a.m., the P.W.S.S. telephone to the F.C. "three warships coming in at great speed" and the F.C. replied "What Class and Nationality" (they were hid from the F.C. Post by Lighthouse). P.W.S.S. replied "they are our ships, they are flying the White Ensign and have answered our signal." The leading ship passed the Lighthouse and the F.C. observed it was painted grey, German. The ships were then firing seawards.

At 8.10 a.m., the leading ship "Van Der Tan" opened fire on the Hough Battery, training 326° range 4150 yards from Hough Battery, (of 2·6″ B.L. gun). The "Seydlitz" was then in sight and the "Bleucher" was about 6,000 yards from Lighthouse Battery training 308. Hough Battery opened fire on the "Van Der Tan" and continued until the guns were in blast at 357°. They were ordered to change target on the "Seydlitz" and carried on with high explosive shell at her upper works until she passed 357°. Meanwhile the "Bleucher" at about 6000 yards training 308 from Lighthouse Battery was engaged by the latter and a 3-round H.E. shell carried away the fore-bridge at about 4,000 yards. (She had shortened range by about 2,000 yards during observation and correction of first two rounds which fell short). The "Bleucher" then got in front of the Lighthouse and masked the L.H. gun. The three ships concentrated their fire on the Batteries for about 15 minutes, and then the "Van Der Tan" and "Seydlitz" moved slowly north and bombarded West Hartlepool Works and Shipyards; the "Bleucher" remaining and engaging the Hough Battery giving a succession of broadsides at about 4,000 yards range. When both guns of Hough Battery engaged her, after "Seydlitz" passed through blast angle, the "Bleucher" quickly steamed seawards, training 288° from Hough Battery. The "Van Der Tan" and "Seyditliz" put about off Crimdan Dene, followed the "Bleucher" and gave us their starboard broadsides as they passed the left front of the batteries, steering east. Our last round was fired at the "Seydlitz" at 8.52 a.m., as she disappeared in the mist.

ARMAMENT.

"Van Der Tan"	34	Guns.	It was estimated
"Seydlitz"	38	,,	they were using
"Bleucher"	36	,,	70 guns.
	108	Guns.	

The "Bleucher" had 2—5·9″ guns dismounted by our fire.

CASUALTIES.

"Bleucher"	10 Killed	19 Wounded.	Reported at Leith.
"Seydlitz" "Van Der Tan"	= 80 Killed	200 Wounded.	

(By report copied from Dutch and German press).

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Hough Battery	2	6″ B.L. Mk. VII Gun.
Lighthouse Battery	1	6″ B.L. Mk. VII Guns.

Casualties of the Durham R.G.A.—2 men killed.

We fired 123 Rounds.

At "Van Der Tan"	70	Rounds.
At "Seydlitz"	20	,,
At "Bleucher"	33	,,
	123	Rounds.

Frequent stoppages due to smoke of enemy shells bursting in front of batteries, on the rocks.

Manning details of the Durham R.G.A. at Hartlepool were :—

11 Officers.
155 Other Ranks.

III. SKIPPER HORSLEY'S STATEMENT.

I, John Horsley, of 21 Bedford Street, Hartlepool, state that, on Wednesday morning the 16th December, 1914, I proceeded to sea in the motor fishing boat "Childrens Friend" at about twenty minutes to eight. When we got outside we saw three warships flying the Union Jack and English White Ensign. Just before that I saw the centre ship exchange signals with the Lighthouse. They then hauled down the Union Jack and White Ensign and ran up the German Flag. That was just before they opened fire on our destroyers about two or three miles E.N.E. of the German Warships.

There were four of our boats together, I turned about to come into Hartlepool but the other three boats ran ashore on the sands north of Hartlepool. Shortly after, the leading ship fired on the batteries. Before they began firing at all, the centre ship showed a red light at the mast head which was answered by the other two with red lights. They fired on the batteries and the first shot from the Lighthouse battery fell short, the second shot would have hit him but was a little to the north. The next smashed on board and appeared to do damage. I saw the shots from the battery hit the ships and as far as I could see very few of the battery shots missed. I saw some of the shots bounce off the ships sides and go into the air.

At this time we were only half a mile from them. The crew had gone below and I called them out to see the way our guns were hitting the ships every time. When we were rounding the breakwater we saw the "Patrol" get hit. The submarine was alongside of her, a little to the north side.

We ran inside the breakwater for three or four minutes. The shells commenced to fall about which appeared to come over the battery.

When we got as far as the Harbour opening, about three minutes

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before the firing ceased we saw the "Forward" being towed out and cleared into West Hartlepool to get out of her road.

(Signed) John Horsley.

Hartlepool.

IV. NOTES.

Since the narrative was written, I have read Mr. Filsen Youngs' Book, in which he states that the "Molke, Sydlitz and Bleucher" were at Hartlepool, and the "Derrfflinger and Van Der Tan" at Whitby and Scarbro', this I learn he copied from Admiral Schiers' Book. The evidence, in my opinion, is conclusive that the "Van Der Tan" was one of the Germans ships at Hartlepool, "Janes' Fighting Ships" gives the "Van Der Tan" 11·2″ guns as 45 cabilre in length and the shell 85 lighter than the 11″ shells of the other Germans ships which have 11″ guns of the 50 calibre in length. Amongst the 11″ "Duds" we found a difference in weight of 11″ shells and a difference in size and number of impressions of the groves on the copper driving bands, this proves that the "Van Der Tan" was at Hartlepool. This is important as the Germans evidently do not wish to admit that we damaged their ships. The "Bleucher" 8·2″ shell were filled with black powder and all burst. The fire of our guns was frequently interrupted by smoke from bursting shell. The telephones fixed on poles were put out of action by the first 11·2″ shell from the Van Der Tan" which struck the right hand front corner of the battery, 4—11″ shells burst wtihin 50 yards of the F.C. Post.

The guns were manned by the Durham R.G.A. (T.A.), about half a dozen District Gunners were in the magazine, the Fire Discipline was perfect, but, as F.C. I had little to do but observe results, the communications being interrupted, the action was practically fought by the B.C's. under standing orders which I had compiled to meet all possible form of attack, our daily routine being Individual Gun Drill in the morning and Fire Discipline in the afternoons, with fortnightly gun practice. The ranges were practically "Point Blank." We got range usually by the first shot, then raised the Point of Impact, got on to their Upper Works and kept there, we had few misses, when the 2—6″ Mk. VII. Guns of Hough Battery "Changed Targets" from "Seydlitz to Bleucher," the B.C. went to Auto sights and A.P. Shell after 19 rounds he changed to H.E. Shell (Case II.) and raised P. of I. and continued on her Upper Works. Then the "Bleucher" steamed rapidly away.

With the exception of the 19 rounds A.P. the action was fought by Case II. The D.R.F. were practically out of action, the repeated concussion of bursting of enemy shell caused vibration of pedestals and shook the D.R.F., but, as the ranges were short due to fog, this did not effect the shooting. The batteries were hit front, rear and both ends. By all the Rules of the War Game we should have been "Knocked Out." 2—6″ shells glanced off the concrete apron around the emplacement and ricoched to the rear and burst. The enemy used Naval Delayed Action Fuzes hence our small loss.

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MECHANICAL TRACTION V. HORSE DRAUGHT.

BY MAJ.-GENL. SIR J. E. W. HEADLAM, K.B.E., C.B., D.S.O.

WITHOUT venturing into the conflict of *opinions* regarding the relative merits of the two forms of draught for artillery, perhaps I may be allowed to intervene on two points of *fact*? In the able essays and articles on the subject which have appeared in the Journal the arguments have in a few cases been supported by references which are not strictly accurate, and I am confident that the writers will welcome such corrections as I am able to offer, for time passes quickly, and if such statements are allowed to remain uncontradicted they soon crystallize into history.

The first case is that of the mobility of the horse-drawn batteries which formed part of the first six divisions. By implication in the "Duncan" Silver Medal Essay, and by explicit statement in Major Crofton's lecture at the Artillery School, a real injustice has been done to those splendid batteries. I can, of course, only speak for my own Division, but in that we were certainly all at one—infantry as much as artillery—in our reliance on our 60-pounders. During those strenuous days between the first clash at Mons and our subsidence into the Flanders mud, never once did they fail to be where and when they were wanted—and they were freely used! To say that the original horse-drawn heavy batteries failed in mobility is on the face of it ridiculous; and I can not help thinking that Major Crofton had in his mind some of the batteries which were formed after the commencement of the war from coast-defence companies. But unfortunately he uses the words "*original*[1] heavy batteries", and this description can properly be applied only to the six heavy batteries which were in existence before the war.

My second case is purely of historical interest. Major Crofton says in his lecture :—

> "Mechanical Transport was unknown in the Boer War, but began "to be mooted for military purposes soon after its conclusion. Its "use was however confined to the M.T. Supply Companies of "the A.S.C."

As a matter of fact, not only were several lines of supply served exclusively by mechanical transport during the later stages of the war, but, on one occasion at any rate, it was employed to take a gun into

[1] The Italics are mine.

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action. The experiment was certainly not entirely successful, but since it is the first example of such a use, it seems worthy of rescue from oblivion. Future historians may regard it as a turning point on the history of artillery! Here is the story.

In July 1900, not long after the occupation of Pretoria, the Boers attacked our troops holding the line of the Magaliesberg, covering Pretoria. The Greys and "O" Battery were cut up at Zilikat's Nek, and the guns captured; the 7th D.G's were driven back on Wonderboom-Poort; and it was anticipated that another effort to break through would be made further east. Sir George Marshall, G.O.C., R.A., was sent out to take command of the outpost line; and, amongst other reinforcements,it was decided to send a 6″ gun to Derdepoort. But the distance was considerable, and ox-draught is very slow. The need was urgent, and the happy idea of utilising one of the steam tractors from the Supply Column occurred to someone. Great was the satisfaction of all ranks at Derdepoort when our big gun came safely into camp that evening, and we all went to sleep chuckling over the surprise in store for the enemy next morning. Imagine my feelings at finding, on my early morning round, the tractor which should have taken our gun into action before dawn lying helpless on its side by the "spruit", feebly churning up the mud! It had gone down for a drink before starting to work, and had slipped in. So, after all, we had to fall back upon the ox to take the gun into action—just as the elephant batteries used to do in the Afghan War. I will leave it to Colonel Phipps to point the moral!

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ANTI-AIRCRAFT ARTILLERY.

BY CAPTAIN K. M. LOCH, M.C., R.F.A.

IN the July number of the R.A. Journal appeared an article entitled "Anti-Aircraft?" by Major H. J. Knerr, C.A.C. This article was reprinted from the "Journal of the United States Artillery." In it the writer expresses his views on the value of anti-aircraft fire in somewhat picturesque phraseology. In fact if the contents of the article could be accepted without reservation, it would sound the knell of the A.A. gunners' pretensions. It is thought that a detailed examination of many of the statements in the article might show up the subject in a somewhat more favourable light for the gunner. As a general rule an attempt to answer an article or rather to disagree with its contents introduces an element of personal antagonism, which is far from the present writers wishes. The fact remains that the casual reader of Major Knerr's article might form somewhat erroneous conclusions as to the real facts of the matter and there is also much in its contents which raises points of interest to the student of air defence. Further it provides an opportunity of describing the not inconsiderable progress which has been made in A.A. gunnery since the armistice both in theory and in practice.

The article referred to starts with the somewhat sweeping statement that "at the present stage of development of anti-aircraft artillery it may be generally stated that aeroplanes are brought down not by gun fire skilfully directed, but as a result of an aeroplane unskilfully manœuvred." As a means of rivetting the attention of the reader from the very beginning, it reminds one of the boy author's classic opening to a society novel. As a statement of fact, it throws out a direct challenge to anyone interested or foolish enough to believe in the value of A.A. fire. Major Knerr can hardly take exception to a mild counter attack.

The rock on which Major Knerr builds his thesis of the futility of A.A. fire is the fact that the target may turn during the time of flight of a shell directed at it. Once the present position of the target has been found, the future position or point of destruction as one optimistic inventor once called it, is limited by a sphere the radius of which is the product of the speed of the target and the time of flight of the shell. This assumes the equal probability of the aeroplane turning in any direction, up, down or sideways at the moment the gun is fired. It offers the gunner what a French writer on the same subject happily calls "a triple infinity of hypotheses." However, admitting this

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formidable obstacle, a certain hit can clearly only be obtained by filling this sphere with bursting projectiles. Major Knerr illustrates this by a diagram comparing the chances of hitting an aeroplane with those of hitting a ship from a coast defence battery. Examining his actual figures, he first assumes a target travelling at 100 miles per hour, i.e. 50 yards per second approximately. He then takes his limiting sphere of movement to be of radius 1,500 yards. In other words he assumes a time of flight of 30 seconds, which is rather unkind to the ballistic properties of the gun. At present with us, 30 seconds is regarded as an extreme time of flight. Twenty seconds would have been a much fairer basis of calculation. Improved ballistics and hence shorter times of flight may not unreasonably be expected to be the feature of new types of A.A. equipments, but admittedly as a set off against this the targets will probably fly higher in the future. Turning for a moment to the question of the probable developments of aircraft in the near future in so far as they effect the A.A. gunner, it is not considered that either the heights at which machines will fly or their speeds are likely to increase by more than 50% over their present performances. Further at the beginning of a war many commercial machines will doubtless be employed by the combatants. It is unlikely that these will possess abnormal qualities as regards speed or "ceiling."

However, to revert to Major Knerr's diagram as it stands. Assuming the effective radius of a burst of a 3″ shell to be 10 yards the odds against a hit can clearly be obtained by comparing the volumes of the two spheres, the actual figures being as $\frac{4}{3}\pi \times 1500^3$ is to $\frac{4}{3}\pi \times 10^3$, that is over three million to one against. On the previous page of his article figures are given admitting that in 1917, 50 aeroplanes were brought down at an expenditure of 10,000 rounds per machine, whilst in 1918, 200 were brought down at a cost of 8,000 rounds each. The astonishing fact remains that here we have a three million to one chance coming off consistently about once in ten thousand times. If only such fortune would smile on us at poker or roulette! The laws of mathematics would appear to have received a nasty set back. An amusing cartoon appeared some time ago showing a prehistoric A.A. gun engaging a dragon. Round the gun were various weird instruments, operated by magicians with abracadabras, macrocosms and all the paraphernalia of mediæval black art. Herein doubtless lies the solution—to defeat the laws of mathematics the A.A. gunner must have used black magic. Further, more machines were brought down in 1918 than in 1917 and at a less average cost in ammunition, clearly a case of more bad shooting and more aeroplanes unskilfully manœuvred. At the same happy rate of growth of inefficiency, had hostilities continued till the present year, amidst a welter of bad shooting and unskilful pilotage, no less than 12,800 machines would have been brought down. The present writer claims to hold all the earlier records for missing aeroplanes. Who knows but that he would eventually have come into his own. However, seriously, the moral is that firstly, aeroplanes which are aimed at are sometimes hit and secondly, that our "triple infinity of hypotheses" has in practice

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boiled down to more practical limits. The assumption of constant course and speed has worked reasonably well in the past.

During the war the comparatively large number of rounds required to bring down an aeroplane by gun-fire was due to a great extent to the following reasons :—

1. The problem of A.A. fire had not been studied before the war, except on somewhat rudimentary lines. Our present knowledge, such as it is, was bought dearly during the stress of war.

2. Quite inadequate means were available for finding the present position of the target either in terms of range or height.

3. No satisfactory instruments were evolved for calculating the future position. Cures for such troubles as secondary and complementary errors could only be arrived at by long and tedious research. In fact so unpromising were the instrumental means at our disposal for calculating deflections that many officers, among whom were not all the stupidest, preferred guessing the deflections, an imperfect method at the best of times.

4. Imperfect knowledge and means of applying the gunnery elements suitable for high angle trajectories. "Rome was not built in a day," but on the whole this side of the problem was in a more advanced condition than the others.

Improvements in the methods for solving the various problems mentioned above met with immediate results, vide the figures for 1918. Incidentally the figures given by Major Knerr presumably refer to the American A.A. defences not to the total results in every theatre of war. The generally accepted figures even as regards our much criticized efforts showed rather better results and these figures were only arrived at by a process of ruthless elimination and took no account of damaged aeroplanes, the numbers of which cannot have been inconsiderable.

Major Knerr is on much less controversial grounds when he states that the endeavour of the A.A. gunner should be to surprise the aeroplane with a well directed salvo of fire, after which the target may be expected to change direction. Subsequent corrections to fire will be difficult if not impossible. This is summarized in the French manual in the words "On ne règle pas le tir sur avion, on le prepare." However, the underlying principle contained therein is that the A.A. gunner must regard an aeroplane as presenting a series of targets, each of which must be dealt with on its own merits rather than on the results of observing bursts. A determined pilot may for tactical or other reasons continue on a straight course. In this case the target must be engaged again, but although the course has not changed a fresh series of deflections will usually be necessary and the position of the bursts of the previous salvo will rarely be of much value for observation purposes.

On the question of equipments raised by Major Knerr, the demand for several natures of gun is generally accepted as sound. He asks, however, for tracer ammunition (presumably for observation of fire!). There is, however, considerable practical difficulty in using tracer

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shell for observation. Unless the exact moment is known at which the tracer reaches the height of the aeroplane it is impossible owing to the curvature of the trajectory to say whether the trajectory is high or low. This difficulty will be appreciated by anyone who had occasion to use incendiary shell during the war. Even distant observation presents very considerable difficulties. At very short ranges when the trajectory appears more or less flat or against targets of the size of airships, a certain amount of value may be expected from outlining the trajectory with tracer shell. But except for shell for incendiary effect it is the position of the burst which matters.

Recent developments in A.A. gunnery.

Before discussing the various points raised in connection with air defence, an endeavour will be made to describe the recent developments in A.A. gunnery and to point out to what extent these developments have rendered straight course flying dangerous. The problems involved are necessarily complex and the instruments devised to solve them must be both accurate and easy to use. Generally speaking, apart from questions of production and portability, it does not matter how complex the interior of an instrument is, provided its use only entails simple processes such as turning handles and reading scales. In producing instruments for A.A. fire each problem has generally required two solutions, one for mobile guns and one for use with defences of a more or less permanent nature. In the former case a certain degree of accuracy has sometimes had to be sacrificed in return for portability.

Problem I. *The determination of the present position.*

The instruments employed are height finders. A two metre Barr and Stroud with automatic means of converting range readings to height (known as the U.B.2.) is already in the service and shows every likelihood of being an instrument eminently suitable for A.A. work in the field. For more or less permanent defences doubtless 3 metre or even larger instruments could be used with correspondingly greater accuracy.

As regards long base, two station, instruments various satisfactory experimental designs have been evolved and it may be said that the problem of producing an accurate and portable two-station instrument is on a fair way to being solved. In any case a great advance has been made on any pattern in use during the war.

It is not too much to predict that an accuracy of 3% should be obtained up to considerable heights. The considerations governing the attainment of such an accuracy though not without interest are too technical to describe here.

Problem II. *The determination of the future position.*

Two main difficulties in this respect remained unsolved at the end of the war.

These were (1) to evolve a means of measuring the velocity of the target and multiplying it by the time of flight of the shell in a simple

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manner and without introducing secondary and complementary errors.

(2). To produce a simple A.A. "time balance." By this is meant a means of selecting a time of flight and hence a fuze length so that the aeroplane and the shell arrive at the future position simultaneously. A moments reflection will show that the problem consists in synchronizing the amount of travel due to two velocities (one constant and one variable). Solutions to both these have been produced experimentally. It merely remains to choose the best out of several attempts. As with human illnesses an exact diagnosis of the trouble is often half-way to the cure.

Problem III. *The calculation of the gunnery elements necessary to obtain a burst at the future position.*

The ballistic data for high angle trajectories are now more perfectly understood. A simple method of calibration and applying ballistic corrections is now being evolved and also means of correcting for the effect of wind on shell. Great improvements in fuzes are also to be expected.

4. The recent development of indirect fire instruments has been most promising and indirect fire may well become the normal method of A.A. fire.

It is not claimed that these ideas and developments are new. They nearly all germinated during the war but owing to the stress of that period they could not be materialized.

As a general conclusion we may state that although much remains to be done considerable progress has been made since the armistice. There will, however, always be scope for ingenuity and now that the solution of the triangle T.O.B. seems to have lost so much of its speculative interest, gunners are recommended A.A. gunnery as a happy field for inventive energy and imagination.

We will now examine a few figures based on the accuracy of the instruments and methods just described. First we must however lay down a few rules for the game.

(1). The radius of effect of a 3″ shell is taken as being 10 yards (experiments have more or less justified this figure.) Heavier shell would naturally produce results more favourable to our argument.

(2). An error of 3% in height at say 15,000 feet limits the present position of the target to within 150 yards higher or lower than the measured height. At an angle of sight of say 45° this represents an error in range ± 200 yards, approximately. (N.B. at lower altitudes the accuracy would be considerably greater.)

(3). In our calculations of the future position it is convenient to measure our errors in terms of time. Our instruments should give us the future position to the nearest second. For a target travelling at 150 miles per hour this represents a distance of 75 yards. We will assume an angle of approach of about 30° when this 75 yards movement results in a forward displacement of about 60 yards and a lateral one of about 35 yards. (If the target is more of a crossing nature our errors in the future position calculations are likely to be smaller.)

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(4). We will assume the aeroplane varies in height 100 ft. either way due to air pockets, etc. (N.B. the A.A. gunner must be prepared to compete with a constant change of height).

(5). Our ballistic corrections and improved fuzes should enable us to place a burst within these limits of error despite 50% zones and other devices employed by providence to keep down shell fire casualties. Incidentally data for 50% zones for high angle-trajectories have not yet been fully worked out, but there is no reason to suppose that they are abnormal.

Assuming the errors described above we have limited the future position of a straight course target in this case to a solid of length 260 yards (i.e. when the present position and future position errors work in the same direction) by 35 yards broad and 60 yards deep.

The volume of this solid is $260 \times 60 \times 35 = 546{,}000$ cub. yards, the volume of a 3″ burst $= \frac{4}{3}\pi \times 10^3 =$ about 4,200 cub. yards.

Hence even assuming that the maximum admissable errors have been made in our instrumentation the odds against a hit with one shell are about 125 to 1 against. If however the errors in our calculations of present and future positions are made in opposite directions (an even money chance) the length of our limiting solid becomes 140 yards and the odds about 75 to 1 against. Combining the two we get an average of 100 to 1, and hence for a salvo from a four-gun battery *25 to 1* against.

Even doubling these odds, it seems that A.A. fire is likely to prove a very serious menace to straight course flying. Pilots who are very naturally inclined to consider the value of A.A. fire from their war experiences or hearsay would perhaps be well advised to consider these figures. Most experienced pilots are prepared to admit the unpleasantness of A.A. bursts when near. Distant shell fire never frightened anyone on land, sea, or in the air.

As a conclusion we may assume at the outbreak of war if A.A. gunnery makes reasonable progress and straight course flying is adhered to, that the hostile air force must count on considerable casualties from gun fire and a corresponding loss of morale. As far as can be judged from watching aeroplanes at work in peace time they frequently fly on straight courses for considerable periods. However, it is no use posing as a Cassandra in other people's affairs. The remedy to these gloomy prophecies appears obvious, namely do not fly on a straight course.

Let us examine the functions of the various types of machines and venture a few surmises as to how their work will be effected by the necessity of changing course every few seconds.

(1). *Bombing Squadrons by day.*

Formations flying in large numbers is no easy matter. If in addition rapid changes of direction are necessary (it is essential that such changes should not be on a regular plan or they may be predicted) it will be extremely difficult to maintain formation. Once the formation

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is broken the individual machines become isolated units incapable of mutual support and hence an easy prey for our own air defence aeroplanes.

(2). *Bombing machines by night.*

Developments in searchlights and sound locator work would point to the probability of most attacking machines being caught and held in the beam, in any case up to considerable heights. Once a machine is caught in the beam the gunners problem is if anything easier than by day. Further if the night flying machine is compelled to change direction every few seconds it will severely militate against its chances of reaching its objective.

The actual problem of bombing.

One of the problems introduced by the advent of flying is the education of the civil population as to the value of bombing as a weapon of war. Provided this education is sound and the "will to war" exists among the people, it will be realized that bombing is only efficacious in so far as it is directed against hampering military and naval operations or destroying the productive capacity of a nation. In London during the war the outward and visible signs of the results of the air raids were crowds in the Tubes and an exodus of certain elements of the population to Brighton and elsewhere. On the whole the main population of London faced these dangers in the same spirit as they faced the war as a whole. The air raids were regarded as one of the disadvantages to be associated with a state of war and as such to be born with equanimity. The same admirable temper was shown by the civil population in other towns, where reasonable steps were taken to provide shelters, etc. It was realized that provided a few simple precautions were taken the danger to the individual was not unduly marked. The real efficacity of bombing therefore lies in the capacity for being able to hit comparatively small objects such as bridges, factories, etc. If in the future, factories, railheads, etc., are built with a view to safety from air raids by judicious spacing of vital areas etc., the difficulties of bombing will be greatly increased.

The actual problem of bomb dropping is in certain respects analogous to that of the A.A. gunner. The pilot has to his advantage that his plane of burst is found automatically, namely the ground and further, he knows his height and speed. Against these advantages he has not a steady platform from which to discharge his projectile. It is thought that bombing accuracy to less than 2% of the height will be extremely hard to obtain. The bearing of this fact, in the case where the target which is being bombed is protected by armour, is often lost sight of by enthusiasts in the press, who would prove that the day of the capital ship is over. However, the point of the matter as far as the A.A. gunner is concerned is, that if the aeroplane is subjected to heavy fire at the moment the bomb has to be discharged, then accurate aim will become a matter of extreme difficulty. (1 second's error in the bombers calculations displaces the point of impact of the bomb by 1 second's travel of the aeroplane say 60 yards).

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Reconnaissance and artillery observation machines.

The work of both these types of machine will be hampered to a varying degree by accurate A.A. fire. This will be particularly marked in the case of reconnaissance machines in a war of movement or in long distance work. In the latter case every moment lost increases the chance of having to encounter enemy aircraft on the return journey. The artillery observer will find his work increasingly difficult, if he has to change direction at the moment when he wishes to observe.

The fighting machine.

Generally speaking a fighting machine employed to patrol an area and to search out hostile machines is free to move and change direction at will without materially effecting its efficiency. The engagement of such targets can only be regarded as a rôle of secondary importance for A.A. guns. If a favourable opportunity arises they should be engaged, as even failing tangible results the firing may serve to warn our machines of the presence of an enemy.

To sum up, we may state that in the future the aeroplane pilot is faced with the alternative of either flying on a straight course and risking being shot down or of continually changing course, which apart from interfering with his duties, affords hostile machines better opportunities to attack him.

Conclusion.

Major Knerr devotes the last two pages of his article to general considerations of air defence. He advocates the use of aeroplanes at the expense of all other natures of air defence. He says "As a matter of fact it (A.A. Artillery) was an expedient forced upon an inferior air power early in the war." The history of the development of the A.A. artillery of this country, France, Italy, and Germany, does not seem to bear out this statement. A.A. artillery was built up as one of many forms of air defence. It was realized that there was and could be no such thing as air supremacy in the sense that a determined enemy could not carry out raids and reconnaissance more or less at will. In two dimensional warfare, given even great naval superiority no sane person would guarantee absolute immunity from raids. In three dimensions and with the great speeds attained by modern aircraft the chances of a successful raid are increased out of all proportion. A.A. artillery has never arrogated to itself the capacity for forming a complete air defence. It is merely a link in the chain of aeroplanes, guns, searchlights, machine guns, nets and other passive means of defence. Each has its functions and certain tasks to fulfill.

The A.A. gunner will be the first to admit that the most efficacious weapon of air defence is the aeroplane with the proviso that sufficient numbers can be concentrated at the right time and place. The problem of concentrating aircraft at a considerable altitude at a given time is a very complex one and its successful solution postulates early warning as to the approach of the enemy. The A.A. gun can function at a few seconds notice. Further, although any commercial machine is a

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potential bomb-dropper, the air defence machine must be of a somewhat special type with great capacity for rapid climbing, a type not likely to be met with in large numbers in civilian flying. The air defence pilot will also require somewhat specialized training. The more detailed considerations governing the question are fully discussed in the "Manual of Air Defence" and elsewhere. The few points just enumerated will suffice to demonstrate the many difficulties confronting the aeroplanes employed on air defence. The considerations which govern the air defence of back areas and towns also apply to the defence of an army in the field. Here again the gun has its particular rôle in establishing the air defence screen, which is so necessary for the protection of an army.

Reference to actual ammunition expenditure during certain phases of the last campaign will further demonstrate the necessity for means of air defence other than aeroplanes. During the retreat in March 1918, as might be expected, A.A. guns were kept very busy. Some forty odd aeroplanes were brought down by A.A. fire during this period, for the most part it must be confessed, low flying targets at close ranges. During the offensive operations which culminated in the armistice the expenditure of ammunition was very considerable, wherever A.A. guns were able to keep up with the advance. On the 4th Army front from August 8th, 1918, onwards, there were four mobile A.A. batteries. The ammunition returns for the last three months of the campaign for these batteries show very marked changes from day to day. On some days less than a hundred rounds were expended and then for several days on end a daily average of 2000 rounds was attained. Close examination of these dates will show that apart from the factor of the weather, the high expenditure of ammunition corresponds exactly to the periods when the enemy's defence stiffened, that is to say generally about the second or third day of a given operation. It appears therefore that in actual practice even during offensive operations, that complete aerial supremacy cannot be expected on the side of the attacker, if the opposing air force possesses any offensive spirit at all.

If, however, we accept that guns have their part to play in air defence, we must insure that adequate training can be given in peace time, so that the defences can be efficiently manned at the outbreak of war. The field armies will doubtless have their quota of regular and territorial units, which should be as efficient as peace time training will allow. There have been considerable developments in practical devices for teaching laying, height finding, etc., and a realistic miniature range has already been in use for some years. Training on these lines in conjunction with actual practice camp work should enable a unit to attain a high standard of efficiency (without discussing the ways and means, it may be taken that the problem of the provision of realistic targets for practice camp has been duly considered and on the whole solved in a satisfactory manner). The real difficulty lies in the provision of a large number of trained A.A. gun detachments for home defence at short notice. The necessity for such a provision is clear but the exact lines on which the detachments are to be obtained is a matter of policy, not concerning the regular soldier. Whether a

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territorial or volunteer scheme is eventually evolved (during the latter stages of the war volunteer gun crews were trained in England for home defence) it would be such a purely defensive measure, that it could not be cavilled at on the grounds of militarism. Assuming for a moment that the men are forthcoming, the question arises as to what methods of fire to employ and what instruments to use, so that detachments may become efficient with the minimum period of training. Certain of our present instruments particularly the U.B.2. height finder require somewhat specialized training. The use of long base height finding instruments is a simpler matter, requiring for the most part merely a capacity for laying a telescope on a moving object. With certain experimental types of instruments it has been found possible to get excellent results with detachments after very few hours of training.

As regards the solution of the remaining processes in A.A. gunnery it is thought that indirect fire offers the most promising field for development. Although no standard type of indirect fire instrument has been evolved, as regards experimental types their name is legion. Some ten are dead and buried, but others evolved from them appear to be rising to better things over the stepping stones of their dead selves. Out of a big field there are one or two distinct favourites and the eventual winner should prove a satisfactory instrument for service use. Most standard service instruments after all have undergone considerable modifications since their initial inception. Whatever methods are eventually evolved the main issue at stake is that the air defences of a nation should be capable of rapid expansion to full strength. It cannot be too much emphasized, how in the first days of a war, air defence may be the decisive factor in the successful mobilisation of the land and sea forces and hence in the campaign itself.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—Dec. 1921.

I. On the outpost line in battle. Lt.-Col. Van Emelen.

II. Operations of the Belgian Army 1914-1918. (Continued).

III. The German enveloping movement of Aug. 1914. Was it a surprise to the French General Staff. Lt.-Col. Nuyten.

(A review and criticism of an article in the French *Revue Militaire Générale* July 1921 by Gén. Dupont entitled "The German High Command in 1914.")

IV. Artillery barrages. Cap. Com. Baron Guillaume.
The writer refers to the new French handbooks. I. "Instruction provisoire sur le service en campagne de l'Artillerie." II. "Règlement provisoire de manœuvre de l'infanterie."
He says that the Belgian hand-books also recognise the barrage without differentiating between moving and position warfare. His conclusions are that in moving warfare barrages are never justifiable. He finishes his article by saying "the barrage is a souvenir of the last war. It was used during position warfare, imposed by the very unusual state of affairs brought about by a long period of stabilisation. Now we want to use the barrage in moving warfare. We must affirm that we see in this idea, faulty tactics, and material impossibility. Let us as frequently as possible revert to the sound doctrine of using the flexibility of artillery fire to act in mass at the time and place desired."

V. Ground observation of artillery fire. (Continued.) Lt.-Col. Grade.

VI. Mobilisation of the Nation for war. II. Cap. Comdt. Dendal.

VII. Scientific organisation and chemistry as an aid to victory. Dr. de Sillevaerts.

VIII. The use of the Cinema in Barracks. A. and F. Poureau.

IX. Notes on Foreign Armies.

Germany. A brief resumé is given of the changes in the armed forces of Germany from immediately after the armistice up to present date.

X. Arms and Services.

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France.

Revue Militaire Générale.—Nov. 1921.

I. Archangel (Macedonia) (Nov. 1915.) Henri Libermann.
II. The recasting of regulations and our war teaching. (Continued.) Lucius.

This months' article is interesting as it deals with the Allied Offensive on the Somme (1st July—late November 1916) under the following headings :—

A. The forces opposed.
B. Our Offensive Methods.
C. Resumé of the battle.
D. The results.
E. Lessons learnt about Offensive action.
F. Lessons learnt about Defensive action.

III. Strategy and operations. Chap. IV. Capt. Kuntz.
IV. Employment of Artillery I. Maj. Pamard.
V. Military Notes on economic questions. Pierre Bruneau.

Revue d'Artillerie.—December, 1921.

I. Essay on the Evolution of War. Lt.-Col. Filloux.
II. About a Firing Manual. Lt.-Col. Mussel.

(A very amusing little skit on the results of training of Artillery Officers at various schools of instruction in shooting.)

III. About Corrections for Wind. M. Garnier.
IV. Communications by wireless. Maj. Laurent.
V. Notes on the causes of production of abnormal rounds. Capt. Gabeaud.
VI. Employment of Artillery in Morocco. (Continued.) Major Canova.
VII. The German Firing Manual of Dec. 4, 1919. (Continued.)
VIII. Miscellaneous News.—Austria. With a 42c/m Skoda Mortar on the French front.

Switzerland.

Revue Militaire Suisse.—Nov. 1921.

I. Rapidity in Attack, during and after the Great War. Jean Fleurier.
IV. The IInd Greek Corps in the Kutahia Operations. Col. Feyler.

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GIFTS AND PURCHASES DURING THE MONTH OF DECEMBER, 1921.

Books Presented.

By The Secretary, War Office.

Report on the Examination of Officers for Promotion, October, 1921.

Military Engineering, (Vol. III.) Bridging, 1921.

By The Author.

Prints of British Military Operations. By Lieut.-Col. C. de W. Crookshank. London (Adlard & Son) 1921.

By The Publishers.

Ypres to Verdun. A Collection of Photographs of the War Areas in France and Flanders. By Sir Alexander B. W. Kennedy. London. ("Country Life") 1921.

By The Secretary, Institution of Civil Engineers.

Minutes of the Proceedings of the Institution of Civil Engineers, Vol. CCIX. London, 1921.

By The Editor.

The Rifle Brigade Chronicle for 1920. Edited by Col. Willoughby Verner. London (Bale, Sons & Danielsson) 1921.

Books Purchased.

With the Russian Army, 1914-1917. By Major-Genl. Sir Alfred Knox. 2 Vols. London, 1921.

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REGIMENTAL LIST. The following Postings have occurred during the period 15th November, to 15th December, 1921.

Postings.—R.H. and R.F.A.

Adam, Maj. R. F., D.S.O., O.B.E., from Staff College, to Att. IV. Res. Bde. 15/12/21
Allhusen, Capt. R., from 38th Batty., to 1st D.A.C. 21/11/21.
Anne, Major H. O. C., M.C., from Adjt. T.A., to Att. 15th Bde. 15/12/21.
Baass, Lieut. G. W. G., from 10th Bde., to 19th Bde. 14/12/21.
Baddam-Whetham, Major S. A., D.S.O., M.C., from Staff, to 78th Batty. 17/11/21
Bell, Lieut. J. W., from Staff, to 62nd Batty. 7/12/21.
Bordass, Lieut.W. H., M.C., from 105th Batty., to H.Q., 22nd Bde. 1/11/21.
Botterill, Lieut. W. R., M.C., from Staff, to III. Res. Bde. 15/12/21.
Clarke, Lieut. H. P., from 17th Bde., to Att. "A" Batty., R.H.A. 30/6/21.
Cottrell, Major (Bt. Lt.-Col.) R. F., D.S.O., from 108th Batty., to 95th Batty. 21/11/21.
Coulter, Lieut. F. J., M.C., from 32nd Bde., to V. Res Bde. Bde. 18/11/21.
Dawson, Lieut. W. C. P., from 10th Bde., to 19th Bde. 14/12/21.
Denvir, Lieut. E. G. J., M.C., from Staff, to 10th Batty. 14/12/21.
Dresser, Major P. B., D.S.O., from Adjt., 23rd Bde., to 108th Batty. 21/11/21.
Dunn, Lieut. J. W. T., from H.Q., 22nd Bde., to 104th Batty. 1/11/21.
Fennell, Lieut. W. J., from "D" Batty. R.H.A., to "I" Batty. R.H.A. 15/10/21
Gatehouse, Capt. R. P., M.C., from Staff, to Adjt., 6th Bde. 15/12/21.
Gayer-Anderson, Lt.-Col. T. G., C.M.G., D.S.O., from Staff College, to V. Res. Bde. 15/12/21.
Gerrard, Lieut. E., from 15th Batty., to 95th Batty. 23/11/21.
Gottwaltz, Capt. R. L., from 98th Batty., to VI. Res Bde. 28/11/21.
Granet, Major G. E. A., D.S.O., M.C., from 31st Bde., to 96th Batty. 15/12/21.
Gregory, Major (Bt. Lt.-Col.) G. M. A., from G.H.Q., Ireland, to 2nd Batty., 1st A.A. Bde. 28/11/21.
Hambleton, Lieut. H. A., O.B.E., from H.Q., 9th Bde., to 28th Batty. 9/12/21.
Hammond, Lieut. H. B., M.C., from 17th Bde., to Att. Arab Levies, Iraq. 14/12/21.
Hill, Major L. R., O.B.E., from Staff College, to 3rd A.A. Batty. 14/12/21.
Holme, Lieut. P. C., from Att. 17th Bde., to 13th Batty. 14/12/21.
Howard, Lieut. T. F. K., from 10th Bde., to 19th Bde. 14/12/21.
Hutchison, Maj. (Bt. Lt.-Col.) H. O., D.S.O., M.C., from Staff to Unposted. 13/12/21.
Kimmims, Lieut. B. C. H., from 113th Batty., to "K" Batty., R.H.A. 12/11/21.
Kitwood, Lieut. R. T. S., from 111th Batty., to "L" Batty., R.H.A. 12/11/21.
Lucas, Major (Bt. Lt.-Col.) C. C., M.C., from Staff College, to Rid. Estab. 15/12/21.
MacLeod, Capt. R., D.S.O., M.C, from 1st Batty., to Adjt., 36th Bde. 16/11/21.
Morrell, 2nd Lt. H. E., from 76th Batty., to H.Q., 9th Bde. 9/12/21.
Muirhead, Major (Bt. Lt.-Col.) M., D.S.O., from 70th Batty., to VI. Res Bde. 23/11/21.
Muller, Lieut. H. V. S., from 9th Bde., to VI. Res. Bde. 9/12/21.
Murray, Lieut. D. M. J., from 10th Bde., to 19th Bde. 14/12/21.
Norton, Maj. E. F., D.S.O., M.C., from Staff College, to Att. IV. Res. Bde. 15/12/21.
Oakeshott, Lieut. J. F. F., from Temp. H.P., to 20th Batty. 8/11/21.
Orr-Ewing, Capt. M. R., M.C., from 7th Bde., to Adjt., 73rd (Northbn.) Bde., T.A. 14/12/21.
Poston, Major (Bt. Lt.-Col) W. J. L., D.S.O., from Att. 34th Bde., to 22nd Batty. 28/11/21.
Reid, Major (Bt. Lt.-Col.) W. R., D.S.O., from 2nd D.A.C., to 37th Batty. 18/11/21
Ritchie, Capt. H. G., from VI. Res. Bde., to 98th Batty. 28/11/21.
Roberts, Lieut. Sir T. L. H. Bart., from 104th Batty., to 35th Batty. 1/11/21.
Selwyn, Capt. J., from Staff. to unposted. 4/9/21.
Simmons, Lieut. S., from 13th Bde., to Att. Trench Mortars, Iraq. 14/12/21.
St. Clair, Major G. J. P., D.S.O., from Staff College, to 44th Batty. 15/12/21.
Straker, Capt. H. G., from Staff, to 129th Batty. 15/12/21.
Strickland, Major G. T., O.B.E., from Staff, to unposted. 7/11/21.
Thomson, Major J. N., D.S.O., M.C., from Staff College, to Att. IV. Res. Bde. 15/12/21.

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Postings R.H. & R.F.A.—Continued.

Walker, Capt. (D.O.) T. H., M.C., from 18th Bde., to R.A. Trgn. Centre. 9/12/21.
Warner, Lieut. E. P., from 17th Bde., to Unposted. 14/12/21.
Wilmer, Major (Bt. Lt.-Col) E. R. G., D.S.O., from 78th Batty., to 65th Batty. 17/11/21.
Winslow, Lieut. L. C., from "D" Batty., R.H.A., to "I" Batty., R.H.A. (A.C.). 15/10/21.
Wren, Lieut. H. G. C., from Att. 1st Res. Bde., R.G.A., to V. Res. Bde.. 8/12/21.

Cancellation.

Huddlestone, Lieut. W. S. The posting and appointment to R.H.A. from 148rd Batty., R.F.A. 12/11/21.

Postings.—R.G.A.

Alexander, Lieut. S. W., from 85th P.A. Batty., to Thames & Medway. 18/12/21..
Anson, Capt. E. A., from Bermuda, to "P" Coast Batty. 6/12/21.
Arnold, Capt. A., from No. 4 Depôt, to Thames & Medway. 14/12/21.
Aucott, Lieut. B., from Att. R.A.F., to II. Res. Bde. 15/12/21.
Baker, Major F. N., from No. 4 Depôt, to S. Irish Coast Def. 8/12/21.
Brittan, Capt. C. H., M.C., from 79th Coy., to 15th Batty. 14/12/21.
Brown, Lieut. R. E., from Att. R.A.F., to I. Res. Bde. 15/12/21.
Buisseret, Lieut. E. J., from II. Res. Bde., to Mauritius. 8/12/21.
Christie, Capt. C. M., M.C,, from Staff, to 18th Batty. 15/12/21.
Cooke, Capt. J. G M. B., M.C., from 14th Batty., to Adjt., 4th Bde. 15/9/21.
Coombes, Capt. H. P., from Staff, to "J" Coast Batty. 8/12/21.
Corbett, Major G. R. de la C., D.S.O., from II. Res. Bde., to H.Q., Irish Comd. 24/11/21.
Couper, Capt. T. J., M.C., from H.Q., Irish Comd., to 5th Bde. 22/11/21.
Crawford, Major (Bt. Lt.-Col.) R. D., D.S.O., from 14th Batty., to Att. I. Res Bde. 29/11/21.
Cruickshank, Lt.-Col. H. St. J., from S. Irish Coast Def., to Forth Coast Def. 30/11/21.
Dance, Capt. H. B., from Adjt. 4th Bde., to 14th Batty. 15/9/21.
Daubuz, Major R. F., from Gibraltar, to Major (I.G.) Hong Kong. 30/11/21.
Davies, Capt. O. H., M.C., from Frontier Garr. Arty., to Survey Co. 15/12/21.
Dean, Major A. C. H., D.S.O., O.B.E., from Portsmouth, to 14th Batty. 29/11/21.
Denham, Lieut. M. W., from 41st P.A. Batty., to 38th P.A. Batty. 14/9/21.
Eastwood, Lieut. R. B., from Att. 1st P.A. Bde., to II. Res. Bde. 15/12/21.
Eberli, Capt. F. H., from 43rd P.A. Batty., to Adjt., 10th P.A. Bde. 25/10/21..
Fendall, 2nd Lieut. W. P., from 36th Batty., to Att. 2nd P.A. Bde. 5/12/21.
Firbank, 2nd Lt. L. T., from Shoeburyness, to 2nd Batty. 28/11/21.
Forbes, Major R. M. N., M.C., from Adjt., 10th P.A. Bde., to 12th P.A. Batty. 20/10/21.
Froude, Capt. C. W., M.B.E., from I.A.C.C. Berlin, to N. Irish Coast Def. 15/12/21.
Graham, Major (Bt. Lt.-Col.) C. A. L., D.S.O., from Staff College, to Att. 2nd P.A. Bde. 15/12/21.
Hardie, Lieut. I. G. G. S., from 41st P.A. Batty., to 27th P.A. Batty. 14/12/21.
Healing, Major N. C., D.S.O., M.C., from Staff College, to Att. 10th Bde. 15/12/21.
Hebert, Major A., from Unposted, to 16th P.A. Batty. 5/12/21.
Hillyard, Lieut. C. A. C., from 2nd Batty., to Coast Def., Malta. 17/10/21.
Hooper, 2nd Lt. W. H., from Shoeburyness to 5th Bde. 28/11/21.
Johnston, Major J. H., D.S.O., from 15th P.A. Batty., to 8th Co., R.G.A. 24/11/21.
Kenyon, Major H. E., D.S.O., from Plymouth, to 15th P.A. Batty. 15/12/21.
King, Lieut. H. J., M.C., from 9th P.A. Bde., to 7th P.A. Batty. 12/12/21.
Knowles, Major G. L., from N. Irish Coast Def., to Sierra Leone Co. 6/12/21
Lilly, Lieut. T. P., from Att. R.A.O.D., to Unposted. 5/11/21.
Maitland Addison, Maj. (Bt. Lt.-Col.) J. F. R. N., from Plymouth, to Att. 1st Res. Bde. 5/12/21.
Mascall, Major M. E., D.S.O., O.B.E., from 8th P.A. Bde., to 533 Batty. 24/11/21.
Painter, Capt. G. W. A., from 12th Batty., to 7th Batty. 7/10/21.
Pargiter, Capt. (Bt. Maj.) R. B., from No. 2 Depôt, to No. 4 Depôt. 13/12/21.

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Postings R.G.A.—Continued.

Paul, 2nd Lt. C. R., from 34th Batty., to Att. 2nd P.A. Bde. 5/12/21.
Pearson, Lieut. S. R., from I.A.C.C. Berlin, to 1st Res. Bde. 15/12/21.
Rawson, Major C. D., D.S.O., from Staff College, to Att. 10th Bde. 13/12/21.
Rees, Lieut. (D.O.) F. T., D.C.M., from Forth Def., to Thames & Medway. 18/11/21.
Rennie, Lieut. T. S., from I.A.C.C. Berlin, to No. 2 Res. Bde. 15/12/21.
Romanis, Capt. D. G., M.C., from Att. Irish Comd., to Unposted. 5/11/21.
Russell, Maj. (Bt. Lt.-Col.) A. G., M.C., from Staff, to No. 4 Depôt. 8/12/21.
Rybot, Lieut. F. J. C., from Att. 1st P.A. Bde., to 2nd P.A. Batty 15/12/21.
Sargeaunt, Capt. P. R., D.S.O., from 10th Batty., to 94th Coy. 1/11/21.
Saunders-Jacobs, Lieut. G. T., from I.A.C.C. Berlin, to "A" Coast Batty. 15/12/21.
Stock, 2nd Lieut. S. M., from Shoeburyness, to 5th Bde. 28/11/21.
Stoddart, Lieut. E., from G.H.Q., Ireland, to Coast Def., Dover. 21/11/21.
Stoddart, Lieut. E., from Dover, to "L" Coast Batty. 14/12/21.
Turnbull, 2nd Lt L. C., from Shoeburyness, to 29th Batty. 28/11/21.
Voelcker, Lieut. J. F., from temp. half-pay, to Coast Def., Milford Haven. 29/11/21.
Webb, Lieut. (D.O.) C. F. G., M.C., from Staff, to Forth Def. 16/11/21.
Woollcombe, Capt. (Bt. Maj.) F. R., M.C., from Dover, to Adjt., Coast Def., Dover. 18/11/21.
Wright, Lieut. T. L., M.C., from Att. 1st P.A. Bde., to 3rd P.A. Batty. 15/12/21.

Cancellation.

Pellew, Major V. H. L., M.C., posting to Hong Kong, dated 11th October has been cancelled.

Staff Appointments.

Royal Artillery.

Drake, Col. W. H., C.M.G., Officer i/c R.H. & R.F.A. Records.
Hanna, Col. J. C., D.S.O., Commdt. Rath Internment Camp. 12/11/21.
Kinsman, Col. G. R. V., C.M.G., D.S.O., Chilean Army. 2/5/21.
Kirke, Col. W. M. St. G., C.B., C.M.G., D.S.O., Col. on the Staff, (General Staff) Aldershot Comd. 17/11/21.

Royal Horse and Royal Field Artillery.

Barrow, Lieut. R., Staff Lieut. A.G. 10 War Office. 1/11/21.
Cave-Bigley, Lieut. J., Seconded for Colonial Employ (Gold Coast Survey). 16/11/21.
Coghill, Lieut. Sir M. N. P. S., Bart., Spec. Serv. Officer, G.H.Q., Constantinople and temp. Capt. 28/4/21.
Gregson, Major G. K., D.S.O., Asst. Commdt. Arty College. 15/11/21.
Huddlestone, Lieut. W. S., A.-D.-C. to G.O.C.-in-C., Southern Command.
Lipscombe, Lieut. H. T. de B., Tank Corps. 25/6/21.
Mackenzie, Lieut. J. P., Att. Royal Corps of Signals. 17/10/21.
Mitchell, Lieut. J., M.C., R.T.O. (Class H.H.) Egypt. 5/8/21.
Morgan, Lieut. R. W., Seconded to Indian Sig. Service. 15/9/21.
Peel, Lieut. L., Attached R.A.O.D. 14/11/21.
Turner, Capt. W. A. S., M.C., G.S.O. 3rd Grade, S.D.I., W.O. 13/12/21.
Wales, Lieut. H. J. H., Tank Corps, 8/11/21.
Warburton, Lieut. P. G. E., M.C., Att. Officer, M.I. 3. B. War Office. 12/12/21.
Wason, Major S. R., Major (I.G.) Arty., Larkhill. 14/11/21.

Royal Garrison Artillery.

Barlow, Lieut. A. E., Attached Tank Corps. 7/9/21.
Barry, Capt. R. J., Attached Tank Corps. 8/9/21.
Bell, Capt. L. G. R. F. H., M.C., D.A.Q.M.G., Mosul Dist., Iraq. 15/10/21.
Brannan, Lieut. W., Attached Tank Corps. 13/9/21.
Bridgeland, Lieut. P., Attached Tank Corps. 15/9/21.
Carey, Major J. L. R., Adjt., Channel Islands Militia. 5/11/21.
Carr, Capt. C., O.B.E., Attached Tank Corps. 12/9/21.
Carter, Lieut. I. P., Attached Tank Corps. 26/8/21.
Cassidy, Lieut. D. M., M.C., Attached Tank Corps. 12/9/21.
Farthing, Lieut. H. H., Attached Tank Corps. 13/9/21.

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Staff Appointments R.G.A.—Continued.

Flood, Lieut. F. W., Attached Tank Corps. 7/11/21.
Goodman, Lieut. R., D.C.M., Attached Tank Corps. 15/9/21.
Heys, Lieut. G. D. A., Attached Tank Corps. 22/8/21.
Heys, Lieut. G. D. A., Tank Corps (Seconded). 22/11/21.
Hillyard, Lieut. C. A. C., Physical Training Supervisor, Malta. 9/12/21.
Knight, Lieut. W. T., M.C., Attached Tank Corps. 15/9/21.
Lewis, Lieut. F. W., M.M., Attached Tank Corps. 1/9/21.
Lilly, Lieut. J., Attached Tank Corps. 13/9/21.
Moore, Capt. H. T., M.C., Bde. Major, Mosul Dist., Iraq. 15/10/21.
Oliver, Lieut. H. M. M., M.C., Attached Tank Corps. 7/9/21.
Pellew, Major V. H. L., Adjt., Kent R.G.A. T.A.
Quickenden, Lieut. R. F., Attached Tank Corps. 1/9/21.
Rogerson, Lieut. G. C., M.C., Seconded under Colonial Office (Gold Coast Survey). 5/10/21.
Ross, Major C., O.B.E., Asst. Supt. Research, Woolwich Arsenal. 7/11/21.
Sayers, Major R. C., O.B.E., D.A.D.A., War Office. 21/9/21.
Sexton, Lieut. A., Attached Tank Corps. 12/9/21.
Shrive, Lieut. R., M.C., Attached Tank Corps. 26/8/21.
Standbridge, Major W. J., Seconded for Gunnery Staff Course. 16/10/21.
Stearn, Lieut. G. F., Attached Tank Corps. 30/8/21.
Symonds, 2nd Lt. E. N. C., Attached Tank Corps. 3/10/21.

Promotions (Regimental).

Cruickshank, Major H. St. J., to be Lt.-Col. R.G.A. 22/11/21.

Promotions. (Non-Regimental).

Gethin, Lt.-Col. Sir R. W. St. L., Bart., C.M.G., D.S.O., to be Colonel 6/12/21 with seniority from 1/1/20.
Loring, Lt.-Col. W., C.M.G., D.S.O., to be Colonel 18/11/21, with seniority 3/6/19.

Honours, etc.

Bannatine-Allison, Maj.-Genl. R., C.B., C.M.G., Retired pay, to be Colonel Commdt., Royal Artillery. 2/12/21.
Brunker, Maj.-Genl. Sir J. M. S., K.C.M.G., Retired Pay, to be Colonel Commdt., Royal Artillery. 2/12/21.
Holbrooke, Col. P. L., C.M.G., D.S.O., to be A.-D.-C. to the King. (Vice Maj.-Genl. T. A. Tancred, C.B., C.M.G., D.S.O., promoted). 17/8/21.
Nixon, Maj.-Genl. A. J., Retired Pay, to be Colonel Commdt., Royal Artillery. 2/12/21.
Trotter, Maj.-Genl. Sir J. K., K.C.B., C.M.G., Retired Pay, to be Colonel Commdt., Royal Artillery. 2/12/21.

To Half Pay List.

Brierley, Lt.-Col. G. T., C.M.G. 22/11/21.
Galpin, Lieut. T. H. 11/12/21.
Hart, Lt.-Col. H. T., C.B.E. 22/11/21.
Hemus, Lieut. A. O. 15/12/21.
Homfray, Lieut. J. M. B., temp. half-pay list (on Colonial Service). 2/11/21.
Hopkins, Lieut. A. C. 10/9/21.
Jones, Lt.-Col. E. H., D.S.O. 10/12/21.
Lyster, Major P. G., temp. half-pay on account of ill health. 23/11/21.
Murphy, Lieut. F. G. A. 16/12/21.
Reay, Lieut. C. C. H. M., temp. on account of ill health. 14/12/21.
Stanley, Lt.-Col. F., D.S.O. 12/12/21.
Wallace, Lieut. B. E., M.C., temp. half-pay on account of ill health. 11/10/21.

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From Half-Pay.

Oakeshott, Lieut. J. F. F., restored next above Lieut. H. J. A. Thicknesse, R.F.A. 8/11/21.
Voelcker, Lieut. J. F., R.G.A., restored next above Lt. C. F. Mermagen. 29/11/21.

Transfers.

King, Major J. F., Removed from R.G.A., on permanent transfer to R.A.O.C. 5/10/21.

Retirements on Retired Pay.

Benson, Lieut. R. W., from temp. half-pay list, on account of ill health. 11/11/21.
Butchart, Major J. A., D.S.O. 2/12/21.
Drought, Major T. A. W. 23/11/21.
Hardinge, Major T. S. N., D.S.O., with rank of Lt.-Col. 26/11/21.
Hepper, Col. L. L., D.S.O., from half-pay list. 22/11/21.
Hill, Lieut. J. N., from half-pay list with rank of Captain. 13/10/21.
Hinton, Lieut. N. R., from half-pay. 15/12/21.
McMullon, Capt. H. G., M.C. 24/11/21.
Nuttall, Col. C. M., D.S.O., from half-pay list. 1/12/21.
Poole, Major H. R., D.S.O., O.B.E. 17/11/21.
Powell, Lieut. J. C., M.C., on account of ill health caused by wounds. 7/12/21.
Reade, Lt.-Col. P. N. G., from half-pay list. 18/11/21.
Scott, Capt. I. B. W., O.B.E., from temp. half-pay on account of ill health contracted on active service, with rank of Major. 24/11/21.
Shaw, Major J. F. de F. 16/12/21.
Tresidder, Major G. W. W. 3/12/21.

Retirements with a Gratuity.

Cave, Lieut. W. J. K., M.M. 9/12/21.
Freeman, Lieut. H., D.C.M., from half-pay, with rank of Capt. 16/12/21.

Resignations.

Johnston, Lieut. D. M. L. 2/12/21.
Lush, Lieut. M. S., with rank of Capt. 23/11/21.

Deaths.

Ellerker, Capt. W. T., at Cologne, Germany. 14/12/21.
Head, Lt.-Col. A. E. M., D.S.O., (retired pay), in London. 15/11/21.
Huyshe, Lt.-Col. D. F. (retired) late Bengal, at Sidmouth. 12/11/21.
Rathborne, Lieut. I. E., R.G.A., at Jamaica. 5/11/21.
Smith, Capt. A., R.G.A., at Ringwood, Hants. 25/11/21.

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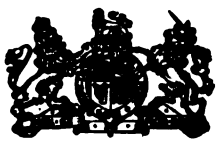

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Corrigenda to
A Solution of the Principal Internal-Ballistic Problem, for long Elliptic Cords."—February, 1922.

p. 444, last line ; p. 455, 3rd and 8th lines ;

for $(A + x)l$ *read* $A(x + l)$

p. 449, Footnote refers to p. 448, 3rd line from bottom.

p. 452, 3rd line from bottom ;

for $-\Sigma M(f, \kappa^1)$ *read* $-M\Sigma(f, \kappa^1)$

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A SOLUTION OF THE PRINCIPAL INTERNAL-BALLISTIC PROBLEM FOR LONG ELLIPTIC CORDS.

BY F. R. W. HUNT, M.A., CANTAB.
Assistant Professor of Gunnery and Mathematics at the Artillery College, Woolwich.

AND

C. E. WRIGHT, M.Sc., LONDON.
Lecturer in Gunnery and Mathematics at the Artillery College, Woolwich.

1. Introduction.

IN order that the weight of a gun, especially of large calibre, may be kept within reasonable limits it is necessary that the pressure of the powder gases be kept reasonably low : the rate at which these gases are evolved should therefore be kept as low as possible. Since the gases are produced at the surfaces of the cords composing the charge, it follows that the surface area of the propellant exposed to the flash from the igniter should be as small as possible.

Generally speaking, the smaller the number of pieces of propellant composing the charge, the smaller will be the surface area. For example, the surface of a single sphere of given mass will be less than the total surface area of a number of spheres of the same total mass. Similarly, one long cylinder has less surface area than a number of spheres of the same radius as that of the cylinder and of the same total mass. Cords (i.e. long cylindrical pieces of propellant) are for this reason, as well as for others, more suitable for guns than small spheres.

The best shape for the cross-section of the cords is, from this point of view, the circle. Of all plane figures of given area the circle has the least perimeter; of all cylinders of given mass and length, therefore, the circular cylinder has the least surface area. Circular cords have, however, a serious disadvantage. As the burning progresses the surface area rapidly decreases, so that the rate of production of gas falls off rapidly; the volume behind the shell, on the other hand, is increasing rapidly; consequently the pressure, which already has been kept reasonably low, falls off rapidly, and the gun, as a high-velocity weapon, loses in efficiency. We therefore require some plane figure whose perimeter does not decrease as rapidly as that of the circle, but yet gives cord of reasonably-small, initial, surface area. Two such types of figure suggest themselves—the rectangle and the oval.

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There is a serious objection to the use of cords of rectangular cross-section. To ensure regularity in the ballistics of the gun it is necessary that the surface area which comes into contact with the igniter flash should be the same for each charge. In packing charges of rectangular cord it is impossible to ensure that the surface areas to be exposed to the flash will be the same; the plane faces of the cords will naturally come into contact with one another in quite an arbitrary manner, so that the surfaces in some cases will be only partially exposed, and in others, will be completely unexposed. The same objection holds for any shape of cord involving flat surfaces. In the case of curved surfaces, on the other hand, contact between cords only occurs over very small areas; so that, practically, the total surface exposed to the flash is equal to the total surface of the charge, and is therefore approximately constant for charges of the same weight.

For guns, especially of large calibre, therefore, cords of oval cross-section should be used, and the oval should be a continuous curve.

In the present paper the ellipse has been chosen as a suitable oval fulfilling the conditions stated above, partly because it is one of the simplest closed curves, and partly because the solution of the principal problem of internal ballistics can be expressed in terms of functions of which tables already exist.

2. Fundamental Equations of the Principal Problem.

Before proceeding to the solution for elliptic cord it is proposed to develop, briefly, the fundamental equations of the principal problem. We do not attempt to justify the various assumptions made in deducing these equations; they are made by most authors and are discussed at length in the various text books of the subject.

The fundamental equation generally assumed to apply to the powder gases during the combustion of the charge is

$$p\,(v - b) = \lambda\ ,$$

where p is the pressure of the gases at a given instant, v is the volume occupied by unit mass of the gases at that instant, and b and λ are constants.

Let us consider the powder gases at a given time t during combustion.

Let A be the cross-sectional area of the grooved bore.

x the distance the shot has travelled during the time t.

Al the volume of the "initial air space", that is, the volume of the chamber less the volume of the charge (l is called the "equivalent length of the initial air space").

C the mass of the charge.

δ the density of the solid propellant.

z the fraction of the charge burnt at time t (z is called the "form function").

Then the volume occupied by the gases at time t is

$$(A + x)\,l + \frac{Cz}{\delta}$$

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The mass of gas is $C\,z$

Hence the volume per unit mass is

$$v = \frac{(A + x)l}{C\,z} + \frac{1}{\delta}$$

The constant b is called the co-volume; it is generally assumed, by writers on internal ballistics, to be equal to the volume of the *solid* propellant per unit mass, or to differ from it by a negligible quantity.

Thus $b = \frac{1}{\delta}$

$$v - b = \frac{(A + x)\,l}{C\,z}$$

and the fundamental law becomes*

$$p = \frac{\lambda\,C\,z}{A\,(x + l)} \quad \text{.....} \quad (2.1)$$

Secondly, we use *Piobert's law of burning.*† This law asserts that the burning takes place by parallel layers, that is, that the thickness burnt along the normal is the same at every point of the cord at a given instant. For various colloidal propellants (including cordite) the rate at which this thickness is burnt has been found experimentally to be proportional to the pressure.‡

If T, measured along the normal at every point, is the thickness burnt off at any instant, we have

$$\frac{d\,T}{d\,t} = k\,p \quad \text{.....} \quad (2.2)$$

where k is a constant.

In addition to equations (2.1) and (2.2) we require the equation of motion of the shell. We will assume that the movement of the charge (solid or gaseous) can be allowed for by adding a certain fraction q of its mass to the mass of the shot.§ We will further assume that the loss of energy due to friction, rotation of the shell, and conduction of heat etc. can be satisfactorily allowed for by adjusting the values of λ and q in any particular case.

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* This equation may be deduced from Noble and Abel's experimental law,

$$p = \frac{\lambda}{\frac{1}{\Delta} - \frac{1}{\delta}}$$

which expresses the final pressure of the gases produced by combustion in a closed vessel in terms of the loading density Δ and the density δ of the solid propellant. The assumption has to be made that this law holds during combustion in a gun.

† This law is ascribed by some authors to *Vieille.*

‡ This law was originally given by *Sebert* and *Hugoniot*; it has been adopted by *Mata, Charbonnier, Bianchi, Hezlet* and other writers in the solution of the principal internal-ballistic problem.

§ There appears to be considerable difference of opinion among authors concerning the most suitable value of q, although the majority agree that the movement of the charge can be accounted for in this way.

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Let w be the mass of the shot, and let v* be its velocity; writing $w' = w + qC$ we have

$$w' \frac{dv}{dt} = pA$$

or

$$\frac{dv}{dt} = \frac{d^2x}{dt^2} = \frac{pA}{w'} \quad \text{.....} \quad (2.3)$$

The equations (2.1), (2.2), and (2.3) are the fundamental equations required.

We may now proceed to the solution of these equations for cords of elliptic cross-section.

3. The form function, z, for elliptic cord.

The form function is the ratio—

$$\frac{\text{mass of charge burnt at a given instant}}{\text{total mass of charge.}}$$

If the cords composing a charge are all of the same cross-section, and are long enough for us to neglect burning at the ends, the form function can be expressed as the ratio :—

$$\frac{\text{area of cross-section of cord burnt at a given instant}}{\text{original area of cross-section.}}$$

Let $A_0 P_0 B_0 O$ be a quadrant of the original cross-section, and let A P B O be the corresponding area remaining after a thickness T has been burnt off. Then, by the law of parallel burning, the normal at P_0 to $A_0 P_0 B_0$ will also be normal to A P B at P, and $P_0 P = T$, provided that T is less than the radius of curvature (ρ) at P_0.

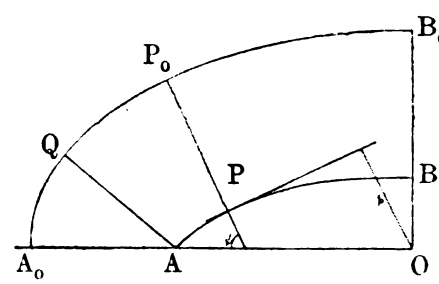

Fig. 1.

The point A corresponds to the point Q on the ellipse whose normal $= T$, hence, when $T >$ minimum ρ of the ellipse, the curve A P B will have a node at A.

When $T <$ minimum ρ of the ellipse, there will be no node at A, and the tangent at A will be perpendicular to O A.

Let $2a$ and $2b$ be the major and minor axes of the ellipse,

ρ be the radius of curvature of A P B at P

ψ be the inclination of the normal at P

p be the length of the perpendicular from O on the tangent at P.

Let the suffix $_0$ denote values of corresponding elements of the ellipse $A_0 P_0 B_0$.

* The use of this letter to denote *volume* is here discontinued.

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Then $\rho_0 = \rho + T$; $\quad p_0 = p + T$; $\quad \psi_0 = \psi$.

Let the suffix $_1$ denote values at A.

Then, when $T < \frac{b^2}{a}$, $\quad \rho_1 = \frac{b^2}{a} - T$; $\psi_1 = 0$; $\quad p_1 = a - T$

when $T >$ or $= \frac{b^2}{a}$, $\quad \rho_1 = 0$; $\quad \psi_1 =$ value of ψ_0 at Q;

$p_1 =$ (value of p_0 at Q) $- T$.

The area of A P B O $= \frac{1}{2}\int_A^B p\,ds$ where ds is an element of arc of the curve

$$= \frac{1}{2}\int_{\psi_1}^{\frac{\pi}{2}} p\rho\, d\psi$$

$$= \frac{1}{2}\int_{\psi_1}^{\frac{\pi}{2}} (p_0 - T)(\rho_0 - T)\, d\psi$$

$$= \frac{1}{2}\int_{\psi_1}^{\frac{\pi}{2}} p_0\rho_0\, d\psi - \frac{T}{2}\int_{\psi_1}^{\frac{\pi}{2}} p_0\, d\psi - \frac{T}{2}\int_{\psi_1}^{\frac{\pi}{2}} \rho_0\, d\psi + \frac{T^2}{2}\left(\frac{\pi}{2} - \psi_1\right)$$

The first term $=$ area swept by the radius vector OP_0 from B_0 to Q $= \frac{1}{2}\, ab\, \phi_1$ where ϕ_1 is the eccentric angle of Q, measured from OB_0.

The second term $= -\frac{T}{2}\int_{\psi_1}^{\frac{\pi}{2}} a\Delta\psi\, d\psi$ where $\Delta\psi = 1 - \kappa^2 \sin^2\psi$, κ being the eccentricity of the ellipse.

$= -\frac{aT}{2}\left[E - E\psi_1\right]$ in the notation of elliptic integrals, E being the complete integral of the second kind; $E\psi_1$, that of the argument ψ_1.

The third term $= -\frac{T}{2}\left(\text{arc of ellipse from } B_0 \text{ to Q}\right) = -\frac{aT}{2} E\phi_1$

Hence when $T > \frac{b^2}{a}$ the area of APBO $=$

$$\frac{1}{2}\, ab\phi_1 - \frac{aT}{2}\left[E - E\psi_1 + E\phi_1\right] + \frac{T^2}{2}\left(\frac{\pi}{2} - \psi_1\right)$$

When $T =$ or $< \frac{b^2}{a}$ the area of APBO $= ab\frac{\pi}{4} - aTE + T^2\frac{\pi}{4}$

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Hence when $T > \frac{b^2}{a}$ the *form function*,

$$z = 1 - \frac{2\phi_1}{\pi} + \frac{2T}{\pi b}\left[E - E\psi_1 + E\phi_1\right] - \frac{T^2}{ab}\left(1 - \frac{2\psi_1}{\pi}\right)$$

and when $T = \text{or} < \frac{b^2}{a}$, $\quad z = \frac{4TE}{b\pi} - \frac{T^2}{ab}$

Writing $\quad T = b\,(1 - f)$,

$$b = \frac{D}{2},$$

and $a = \frac{b}{\kappa'}$ where κ' is the complementary modulus ($= \sqrt{1 - \kappa^2}$), we have, when $f < 1 - \kappa'$,

$$z = 1 - \frac{2\phi_1}{\pi} + \frac{2(1-f)}{\pi}\left[E - E\psi_1 + E\phi_1\right] - \kappa'\,(1-f)^2\left[1 - \frac{2\psi_1}{\pi}\right] \quad \text{.....} \quad (3.11)$$

and when $f > \text{or} = 1 - \kappa'$, $\quad z = \frac{4E}{\pi}\,(1 - f) - \kappa'\,(1 - f)^2$ ..... (3.12)

The latter follows (as it should) at once from the former if we put $\phi_1 = \frac{\pi}{2}$, $\psi_1 = 0$.

The following identities are used in the succeeding analysis :—

$$\kappa' \tan\phi_1 \tan\psi_1 = 1 \quad \text{.....} \quad (3.2)$$

$$\Delta\phi_1\,\Delta\psi_1 = \kappa' \quad \text{.....} \quad (3.3)$$

$$1 - f = \Delta\phi_1 \text{ when } f < 1 - \kappa' \quad \text{.....} \quad (3.4)$$

4. Solution for Gun.

The equations relating to the motion etc. during combustion of the charge, when friction and other causes of loss of energy are allowed for as mentioned in section 2, are :—

$$p = \frac{\lambda Cz}{A(x+l)} \quad \text{.....} \quad (4.1)$$

$$D\frac{df}{dt} = -2kp \quad \text{.....} \quad (4.2)$$

$$\frac{dv}{dt} = \frac{d^2x}{dt^2} = \frac{pA}{w'} \quad \text{.....} \quad (4.3)$$

From (4.2) and (4.3) it follows at once that*

$$v = F\,(1 - f) \quad \text{.....} \quad (4.4)$$

Where $F = \frac{A\,D}{2kw'}$, a constant ..... (4.41)

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Noting that $v = \frac{dx}{dt}$

and eliminating t and p between (4.4), (4.2) and (4.1), we have,

$$\frac{dx}{x+l} = -M \frac{1-f}{z} df \quad \text{.....} \quad (4.5)$$

Where $M = \frac{A^2D^2}{4\lambda Ck^2w'}$, a constant ..... (4.51)

Integrating we have

$$\log_e \frac{x+l}{l} = M \int_f^1 \frac{1-f}{z} df$$

This integral is intractable when $f < 1 - \kappa'$, but it can be evaluated by any method of quadrature for definite values of f and κ'.

Let us define $\Sigma\ (f,\ \kappa') = \int_f^1 \frac{1-f}{z} df$

Then $\log_e \frac{x+l}{l} = M\ \Sigma(f, \kappa')$ ..... (4.6)

and, in particular, if x_2 denote shot travel to the point at which the charge is completely consumed,

$$\log_e \frac{x_2+l}{l} = M\ \Sigma(0, \kappa') \quad \text{.....} \quad (4.61)$$

Maximum Pressure.

Differentiating (4.1) logarithmically,

$$\frac{dp}{p} = \frac{z'}{z} - \frac{dx}{x+l}$$

Where $z' = \frac{dz}{df}$

Whence, from (4.5),

$$\frac{dp}{p} = \frac{z' + M(1-f)}{z} df$$

Hence, if f_1 denote the value of f corresponding to the point of maximum pressure,

$$z'(f_1) = -M(1-f_1) \quad \text{.....} \quad (4.7)$$

z' may most easily be obtained as follows :—

We have (fig. i.)

$$4 \times (\text{area APBO}) = \pi a^2 \kappa' (1-z)$$

therefore $4 \times \frac{d}{dT}$ (area APBO) $= \pi a z'$ since $T = a\kappa'(1-f)$

* The initial value of f is 1.

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But $4 \times \frac{d}{dT}$ (area APBO) $= -4 \times$ arc APB $= -4\int_{\psi_1}^{\frac{\pi}{2}} \rho\, d\psi$

$$= -4\int_{\psi_1}^{\frac{\pi}{2}} \rho_0 d\psi + 4T\left(\frac{\pi}{2} - \psi_1\right)$$

$$= -4aE\phi_1 + 2\pi a\kappa'(1-f)\left(1 - \frac{2\psi_1}{\pi}\right)$$

Hence $z' = -4\frac{E\phi_1}{\pi} + 2\kappa'(1-f)\left(1 - \frac{2\psi_1}{\pi}\right)$

So that $-\frac{z'}{1-f} = \frac{4E\phi_1}{\pi(1-f)} - 2\kappa'\left(1 - \frac{2\psi_1}{\pi}\right)$, an expression which can be tabulated as a function of f and κ'.

Let it be called $Q(f, \kappa')$

Then we have $Q(f, \kappa') = M$ ..... (4.71)

Whence, from (4.1) and (4.6), the maximum pressure,

$$p_1 = \frac{\lambda Cze^{-M\Sigma(f_1, \kappa')}}{Al}$$

and, since f_1 is a function of κ' and M,

$$p_1 = \frac{\lambda C}{Al} P(M, \kappa') \quad \text{..... (4.81)}$$

Where $P(M, \kappa') = z\, e^{-M\Sigma(f_1, \kappa')}$ ..... (4.82)

and can be tabulated as a function of M and κ'.

Note. If $M > \frac{4E}{\pi\kappa'} - 2\kappa'$,

p_1 occurs before $f = 1 - \kappa'$;

f_1 is then equal to $1 - \frac{4E}{\pi(M + 2\kappa')}$

Muzzle velocity.

After the charge is completely consumed, equations (4.1) and (4.2) are inapplicable; equation (4.3) however still holds.

It is generally assumed that the gases expand adiabatically after combustion is complete. The relation between pressure and volume is then expressed by the equation.

$$p\,(\text{volume})^{\gamma} = \text{constant},$$

where γ is Kirchhoff's ratio for the gases.

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If p_2 be the pressure at the point of complete combustion, and x_2 the shot travel to this point, we have

$$p\,(x + l)^\gamma = p_2\,(x_2 + l)^\gamma \quad \text{.....} \quad (4.91)$$

and this equation takes the place of (4.1) and (4.2).

Equation (4.3) may be written in the form

$$v\frac{dv}{dx} = \frac{pA}{w'} \quad \text{.....} \quad (4.92)$$

Eliminating p we have

$$v\frac{dv}{dx} = \frac{Ap_2}{w'}\left(\frac{x_2 + l}{x + l}\right)^\gamma$$

Integrating from the point of complete combustion x_2 to the muzzle, x_3,

and putting $p_2 = \dfrac{\lambda C}{A\,(x_2 + l)}$ (by equation (4.1))

and $v_2 = F$ (by equation (4.4))

We have

$$v_3^2 = F^2 + \frac{2\lambda C}{w'}\,(\gamma - 1)\left\{1 - \left(\frac{x_2 + l}{x_3 + l}\right)^{\gamma - 1}\right\}$$

v_3 being the muzzle velocity.

Or, using (4.41) and (4.51),

$$F^2 = \frac{\lambda CM}{w'}$$

and the muzzle velocity is given by

$$v_3^2 = \frac{\lambda C}{w'}\left[M + 2(\gamma - 1)\left\{1 - \left(\frac{x_2 + l}{x_3 + l}\right)^{\gamma - 1}\right\}\right] \quad \text{.....} \quad (4.93)$$

the value of x_2 being obtained from (4.61).

5. Calculation of tables required.

For the determination of the most important elements, namely, maximum pressure, shot-travel to the point of complete combustion, and muzzle velocity, two tables are required, viz :—

$$P\,(M, \kappa') \quad \text{and} \quad \Sigma(0, \kappa')$$

The former is a table of double entry, the latter, one of single entry. In order to calculate $P\,(M, \kappa')$, however, values of $\Sigma\,(f, \kappa')$ are required, so that it would probably be better, and would at the same time render the solution more elastic, if $\Sigma\,(f, \kappa')$ were calculated. A table of z would also be useful for the study of the pyrostatics of elliptic cord.

We shall indicate the methods of calculating these tables.

The form function. z.

This function may be tabulated in terms of f and κ'.

We have, from (3.4),

$$(1 - f)^2 = 1 - \kappa^2 \sin^2\phi_1$$

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Whence ϕ_1 can be obtained, for given values of f and $\kappa' = \sqrt{1-\kappa^2}$; ψ_1 can then be found from (3.2), namely,

$$\kappa' \tan \phi_1 \tan \psi_1 = 1$$

$E(\kappa)$, $E(\phi_1, \kappa)$ and $E(\psi_1, \kappa)$ can be obtained from a table of the elliptic integral of the second kind, and z is then determined from (3.11)

$$z = 1 - \frac{2\phi_1}{\pi} + \frac{2(1-f)}{\pi}\left[E - E\psi_1 + E\phi_1\right] - \kappa'(1-f)^2\left[1 - \frac{2\psi_1}{\pi}\right]$$

for values of $f > 1 - \kappa'$.

For $f >$ or $= 1 - \kappa'$ the formula (3.12)

$$z = \frac{4E}{\pi}(1-f) - \kappa'(1-f)^2$$

presents no difficulty.

The function $\Sigma\ (f,\kappa') = \int_f^1 \frac{1-f}{z} df$.

For values of $f >$ or $= 1 - \kappa'$ we have, using (3.12),

$$\int_f^1 \frac{1-f}{z} df = \int_f^1 \frac{\pi df}{4E - \pi\kappa'(1-f)} = -\frac{1}{\kappa'} \log_e \left\{1 - \frac{(1-f)\pi\kappa'}{4E}\right\},$$

an expression which presents no difficulty.

For values of $f < 1 - \kappa'$, we have

$$\int_f^1 \frac{1-f}{z} df = -\frac{1}{\kappa'} \log_e \left\{1 - \frac{\kappa'^2\pi}{4E}\right\} + \int_f^{1-\kappa'} \frac{1-f}{z} df$$

For the latter integral a method of quadrature must be employed; a central-difference method would be most suitable.

The function $P\ (M, \kappa')$.

For given values of f_1 we can determine M from

$$M = Q\ (f_1, \kappa') = \frac{4E\phi_1}{\pi(1-f_1)} - 2\kappa'\left(1 - \frac{2\psi_1}{\pi}\right)$$

(or, this function could be tabulated at the same time as z is determined).

$\Sigma(f_1, \kappa')$ and z can be obtained from the tables of these functions, and then

$$P\ (M, \kappa') = ze^{-\Sigma M(f,\ \kappa')}$$

can be calculated and tabulated either as a function of (f_1, κ'), or of (M, κ'). The latter is probably more convenient.

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Note. If one definite value of κ' (the ratio between the least and greatest diameters of the cord) be fixed for all sizes of cord, these tables become tables of single entry and the labour of calculating them is greatly reduced.

6. Summary of results.

For the determination of the maximum pressure, the shot travel to the point of complete combustion and the muzzle velocity, two tables are required, namely,

$$\Sigma(0, \kappa') \text{ and } P\ (M, \kappa')$$

and the necessary formulæ are :—

$$\kappa' = \frac{\text{least diameter of cord}}{\text{greatest diameter}} \quad \ldots\ldots (6.01)$$

$$M = \frac{A^2D^2}{4\lambda k^2 C w'} \quad \ldots\ldots (6.02)$$

Maximum pressure; p_1.

$$p_1 = \frac{\lambda C}{A\,l} P\ (M, \kappa') \quad \ldots\ldots 6.03)$$

Shot travel to point of complete combustion; x_2.

$$\log_e \frac{x_2 + l}{l} = M\,\Sigma\ (0, \kappa') \quad \ldots\ldots (6.04)$$

Muzzle velocity; v_3.

$$v_3^2 = \frac{\lambda C}{w'}\left[M + 2\,(\gamma - 1)\left\{1 - \left(\frac{x_2 + l}{x_3 + l}\right)^{\gamma - 1}\right\}\right] \quad \ldots\ldots (6.05)$$

In order to determine the pressure and velocity at any given shot travel x we require two tables, namely,

z as a function of f and κ' and $\Sigma(f, \kappa')$,

and the necessary formulæ are :—

When $x < x_2$

$$\log_e \frac{x + l}{l} = M\Sigma(f,\kappa') \quad \ldots\ldots (6.06)$$

Whence f may be determined, and thence z from the table.

The pressure p is given by

$$p = \frac{\lambda C z}{A(x + l)} \quad \ldots\ldots (6.07)$$

and the velocity

$$v = \frac{AD}{2kw'}\,(1 - f) \quad \ldots\ldots (6.08)$$

When $x > x_2$

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The pressure p is given by

$$p = \frac{\lambda C}{A} \frac{(x_2 + l)^{\gamma - 1}}{(x + l)^{\gamma}} \quad \text{.....} \quad (6.09)$$

and the velocity v by

$$v^2 = \frac{\lambda C}{w'}\left[M + 2(\gamma - 1)\left\{1 - \left(\frac{x_2 + l}{x + l}\right)^{\gamma - 1}\right\}\right] \quad \text{.....} \quad (6.10)$$

7. Units and Dimensions.

In conclusion a few words concerning units may be necessary. In our solution of the problem we have assumed that a consistent system of units has been used for all quantities; that is to say, we have assumed the *same* unit of *mass*, the *same* unit of *length* and the *same* unit of *time* throughout. On such a basis in practice, however, some of the quantities would be inconveniently large. For example, if the unit of mass throughout be the pound avoirdupois, the pressure, expressed in pounds' weight per square inch, would be inconveniently large.

We will confine our attention to British units, and, after stating the units generally adopted for the various quantities, we will indicate what modifications are necessary to the equations in order that these quantities may be determined in their proper units.

Pressure is measured in tons' weight per square inch.

Volumes are measured in cubic inches, *areas* in sq. inches and *lengths* in inches.

Masses of charge and shell are measured in pounds.

Velocity is measured in feet per second; *time*, in seconds.

The constant λ is generally given as pressure per unit density of powder gas; this density, which is deduced from the expression $\frac{C}{A(x + l)}$ is measured in terms of the density of water. Since 27·73 c. ins. of water weigh one pound, equation (2.1) becomes

$$p = \frac{27{\cdot}73 \lambda C z}{A(x + l)} \text{ tons' weight per square inch.}$$

k is measured in inches per second per unit pressure (one ton per sq. inch).

Equation (2.2) therefore needs no modification.

Equation (2.3) becomes

$$\frac{dv}{dt} = \frac{1}{12}\frac{d^2x}{dt^2} = \frac{2240 g p A}{w'} \text{ feet per second per second,}$$

since x is measured in inches; g is the acceleration due to the force of gravity.

The equations (6.01), (6.04) and (6.06) of §6 require no modification.

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The remainder require modification as follows :—

Equation (6.02).

$$M = \frac{12 \times 2240 g A^2 D^2}{27{\cdot}73 \times 4k^2 \lambda C w'}$$

Equation (6.03).

$$p_1 = \frac{27{\cdot}73 \lambda C}{Al} \; P\,(M, \kappa') \text{ tons' weight per square inch.}$$

Equation (6.05).

$$v_3^2 = \frac{2240 g \times 27{\cdot}73}{12} \; \frac{\lambda C}{w'} \left[M + 2(\gamma - 1) \left\{ 1 - \left(\frac{x_2 + l}{x_3 + l} \right)^{\gamma - 1} \right\} \right]$$

(feet per second)^2

Equation (6.07).

$$p = \frac{27{\cdot}73 \lambda C z}{A(x + l)} \text{ tons' weight per square inch.}$$

Equation (6.08).

$$v = \frac{2240 g A D}{2kw'} \; (1 - f) \text{ feet per second.}$$

Equation (6.09).

$$p = \frac{27{\cdot}73 \lambda C}{A} \; \frac{(x_2 + l)^{\gamma - 1}}{(x + l)^{\gamma}} \text{ tons' weight per square inch.}$$

Equation (6.10).

$$v^2 = \frac{2240 g \times 27{\cdot}73}{12} \; \frac{\lambda C}{w'} \left[M + 2(\gamma - 1) \left\{ 1 - \left(\frac{x_2 + l}{x + l} \right)^{\gamma - 1} \right\} \right]$$

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TRANSLATION, FROM THE REVUE MILITAIRE GÉNÉRALE, OF AN ARTICLE BY REGINALD KANN.

The first Episode in the Eastern Campaign.

The operation at Koum—Kalé in the Dardanelles.

BY LIEUT. G. R. JOHNSTON, R.F.A.

THE attempt at forcing the Dardanelles by the allied squadrons on March 18th had ended in a complete repulse. It was obvious that henceforth the fleet would be unable, by its own resources, to break through the Straits: it was necessary first to get possession of the banks. Thus the roles became reversed. Originally the navy was to open the way for the expeditionary force; it now became the task of the expeditionary force to prepare the way for the ships.

A disembarkation in the presence of the enemy always constitutes a difficult operation, especially when the adversary is forewarned. Now at the Dardanelles, where the armoured ships had been bombarding the forts for several weeks, the Turks had had all the time required for concentrating considerable forces, and for covering the sea coast with entrenchments. Each day the development of the lines of defence and networks of wire were proceeding apace, making the task of the assailants the harder. Consequently it was necessary to hurry. Unfortunately that was out of the question. A fortnight before the French expeditionary force had embarked with the greatest haste, in order that it should not arrive late at the moment of the forcing of the Straits. Moreover the loading of the transports was carried out without any method, with the result that in most of the ships the material indispensable to the troops on disembarking—the ammunition, for instance— was lying at the bottom of the hold, covered with masses of articles for which there was no immediate use. Hence the need for a complete re-adjustment, which could only be carried out alongside a quay. The port of Alexandria was chosen. On March 25th, the transports left the roads of Lemnos where they were at anchor; they returned there on April 18th, ready this time, after a stay of two weeks in Egypt.

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On the 19th a conference was held on board the battleship '*Queen Elizabeth*' between General Sir Ian Hamilton, commanding the land forces, Admiral de Robeck, commanding the naval forces, General d'Amade, commanding the French expeditionary force, and Rear-Admiral Guépratte, commanding the French naval division. General Hamilton laid before them his plan of operations, which consisted of taking possession of the plateau of Kilid-Bahr, on the Gallipoli peninsular, a position dominating the forts on the interior of the Straits. The British troops were to disembark at the southern end and on the west coast of the peninsula, whilst a French detachment was to make a temporary landing at Koum-Kalé, on the coast of Asia, with the object of preventing the enemy from impeding, from this point, the disembarkations on the peninsula. Lastly the allied fleets were to carry out two demonstrations, as pretence disembarkation preparations, one at Bulair, (the point at which the Gallipoli peninsula joins Thrace), the other in the bay of Besika, about fifteen kilometres south of Koum-Kalé.

In a special order General Hamilton detailed the mission of the French detachment and its composition. By the terms of this order the operation at Koum-Kalé was only to have the character of a diversion, tending to cause the enemy to evacuate the region situated on the west of the river Mendéré and on the north of Yeni-Chéir during the period of disembarkation on the European coast. The strength to be employed was one regiment of infantry and one battery of field artillery. The attack was fixed for April 25th at dawn.

On receipt of these instructions General d'Amade selected Colonel Ruef to command the detachment, and placed under his orders :

(a). The 6th combined colonial line regiment (Lieut.-Colonel Noguès), composed of one battalion of colonial infantry (Major Chalbert), and two battalions of Senegalese sharpshooters (Majors Simonin and Nibandeau).

(b). The section of machine guns (on foot) belonging to the infantry regiment of chasseurs d'Afrique.

(c). The 33/8th field battery.

(d). A section of engineers and a detachment of signallers.

(e). No. 1 ambulance.

These details were embarked on the transports '*Savoie*', '*Vinh-Long*', '*Carthage*', and '*Théodore-Mante*'. In addition, the '*Ceylon*' was loaded with disembarkation materiel, and the hospital ship '*Duguay-Trouin*' accompanied the expedition. The disembarkation was to be supported by the allied division of Rear-Admiral Guépratte, consisting of the battleships '*Jauréguiberry*' (flag ship), '*Henri IV*', '*Prince George*' (British), the cruisers '*Askold*' (Russian), '*Jeanne d'Arc*', the French destroyers, torpedo boats and dredgers, and the tug-boat '*Goliath*'.

On the 24th April, the eve of the operation, a disembarkation manœuvre, serving as a sort of rehearsal, was carried out under the supervision of General d'Amade in the outer roadstead of Mudros

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(Lemnos). In the course of this exercise the disembarkation operations of all the details destined to take part in the real action next day lasted three hours and ten minutes. In the evening General d'Amade embarked on the '*Jauréguiberry*.'

The French naval division, and the transports, which had on board Ruef's detachment, left the Mudros roadstead at 10 p.m. on April 24th and arrived the next day at 4.20 a.m. at the entrance of the Straits. The day broke fine; the sea was absolutely calm; a light mist was hanging over the European and Asiatic coasts.

The ground upon which the French troops were to operate was a narrow tongue of sand confined between the sea and the course of the Mendéré (Méandre); it terminated in the point of Koum-Kalé (Castle of Sand), where an old Turkish fort rises up, behind which stretches the village. The ground, primarily a flat stretch of about 2 kilometres, rises rapidly, in continuation, up to the little plateau of Orhanié, then by a still steeper slope it reaches the table-land of Yeni-Chéir, which dominates the sea from a distance of a hundred metres. The twisting course of the Mendéré winds its way across a marshy plain, intersected by streams, which extends eastward as far as the straggling buildings of In-Tépé and Hissarlik.

The fort of Koum-Kalé is a square of masonry supported by corner bastions. A hundred yards further east are to be seen the remains of a boom, which could not be utilized for a disembarkation. A platform, a few metres square, situated right at the base of the place, is the only point hidden from view from Yeni-Chéir and In-Tépé.

The Turkish infantry was holding the fort, the village, and the cemetery, which occupies an eminence 300 metres from the last houses, near the wooden bridge by which the Hissarlik road crosses the Mendéré. The cemetery commands the neighbouring ground, forming as it were a natural redoubt between the stream and an almost entirely dry piece of marsh land that intersects the middle of the peninsula. Lines of trenches connected up the cemetery to Orhanié. Several field and heavy batteries of various calibres were in position on the heights of In-Tépé and Yeni-Chéir. Their lines of fire converged on Koum-Kalé, completely sweeping the beach which lies between this point and the cliff of Orhanié.

Disembarkation on this beach was out of the question, it being too much in view. The platform at the foot of the fort, under the plunging fire from the two bastions, and from the curtain which connects them, would have to suffice; this latter, it is true, had suffered a good deal from the bombardments; practicable breaches were distinguishable in it.

On April 25th at daybreak the ships of Guépratte's division took up their battle positions. As soon as visibility allowed they opened fire, the '*Askold*' and the '*Jeanne d'Arc*' on Yeni-Chéir, the '*Jauréguiberry*' and '*Henri IV*' on Koum-Kalé. The Turkish artillery only replied with a few badly ranged rounds.

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At 6.20 a.m. the Rear-Admiral issued orders for the disembarkation. The current, running at more than four knots, impeded the operation, for the ships' boats and steam launches, used for towing the landing gangways, were too feeble and could not make headway. They had to be replaced by the trawlers and torpedo-boats. Several hours were thus lost, firstly on account of manœuvres for anchorage, and secondly because the new means of tugging were not sufficient in number, and it would be necessary to make two trips instead of one, and even three for the details on board the '*Vinh-Long*'.

In the first trip the details transported were: five companies of infantry (one European and four Senegalese), the half company of engineers, the four machine gun sections, and the regimental staffs of the three battalions.

The details from the '*Vinh-Long*' (10th and 11th companies) were the first to get ashore. They primarily made their way towards the destroyed boom, and were greeted by a violent artillery and rifle fire, supported by the fire from machine-guns perched on the top of one of the mills situated near the mouth of the Mendéré. A shell struck one of the whale-boats; all the personnel on board were either killed or drowned. The small boats were allowed to drift as far as the rising ground at the platform. At this moment a well-directed shot from the '*Henri IV*' brought down the mill, and rendered the machine-guns ineffective, the fire from which had caused losses amongst the troops crowded together in the small boats. Meanwhile these latter continued to be harassed by the bullets from the Turkish infantry lining the rampart. Without waiting for the boats to come alongside Captain Brison, commanding the 10th company, leapt into the water, leading his men in his wake in a splendid rush. The Senegalese, in a trice, were on the shore and scaling the wall, led by Second-Lieutenant Bonavita, who was killed just as he reached the parapet. Captain Brison, his arm pierced by a shot, continued to direct his unit, which had soon captured the fort in spite of heavy losses.

The 10th company was joined by the 11th, then by the other elements of the first convoy. At 11.15 a.m. the whole of the village was occupied, and the troops which had been landed proceeded to put the outskirts in a state of defence.

After mid-day the landing of the second echelon commenced. Three 75-mm. guns were hauled along the shore, and brought into position as a battery on the counter-slope of a little hill to the west of the village, and opened fire on Yeni-Chéir. The regimental aid-post did its work under the shelter of the southernmost bastion of the fort. The disembarkation of the infantry was not yet entirely completed when, towards 3 p.m., Colonel Ruef gave orders for the launching of three companies (the 1st, 2nd, and 8th) on Orhanié, supported by the fire of the battery. As soon as they debouched from the village, these units were taken in the flank by the fire of the machine-guns and infantry intrenched in the cemetery; they were pinned to their ground. The 3rd and 9th companies were thereupon launched against the cemetery. This movement was also held up after the first bound.

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At this juncture the situation was as follows: the eastern outskirts were held by the 5th, 11th, and half of the 12th and 10th companies; the southern sector by the 3rd, 9th, 1st, 2nd, and 8th companies. All the machine gun sections were in the firing line. One gun had been man-handled to the southern outskirts for the purpose of firing point blank into the cemetery. The 4th, 6th, 7th, and half of the 12th company, were in reserve. On the approach of nightfall orders were given to hold the line now occupied. Wire entanglements were stretched in front of the trenches.

At 8.30 p.m. the enemy, who had brought up fresh forces from In-Tépé a short time before sun-down, delivered a general attack against our position. There were at least three Turkish battalions engaged. They were completely stopped at a distance of less than 100 metres from the trenches. Two assaults of a less violent character, at 10 p.m. and 1 a.m. respectively, were repulsed with ease. Finally at day-break, after an ineffectual bombardment, the Turks launched a fourth offensive along the beach on our right, which it had not been possible to furnish with wire entanglement. A few of the enemy infantry came up to within contact distance, without succeeding in breaking through the line. The machine-gun sections of the chasseurs d'Afrique and the 1st battalion contributed very effectively in repulsing the attackers. At sun-rise it was ascertained that in front of all our trenches the ground to an extent of from 100 to 400 metres, were strewn with Turkish corpses.

Colonel Ruef had decided to renew the attack on the cemetery in the morning with the co-operation of the cruiser '*Latouche-Tréville*', expected from Syria in the course of the night, which was to be brought to bear (broadside on) in the Straits off the mouth of the Mendéré. The flag-ship not having yet rallied the squadron, the operation was postponed.

At 7 a.m. the enemy occupying the cemetery seemed to show signs of an intention to give themselves up; they waved pennons and white handkerchiefs, but as they did not lay down their arms, our men continued to fire. After a short time a group of about 50 Turks threw down their rifles, and approached the trenches. Fire was ceased, and the party was conducted within our lines. Soon other parties carrying white flags presented themselves before our front, making signs to the effect that they wished us no mischief; but they had remained armed. Therefore the French companies again opened fire. A few Turks replied to this, but their officers made them stop, and had several repetitions of the 'cease fire' sounded. Orders were thereupon given on our side to stop firing. The enemy drew near and mixed with our men. Numbers of Turks were disarmed without resistance, and conducted to the rear. Others refused to give up their rifles. Believing that fear of the treatment which awaited them was the reason for this reluctance, Captain Roeckel, of the colonial infantry, with two interpreters, went unarmed into the midst of a group of enemy troops, and asked to speak to the senior officer present. These soldiers were led by the Turks to the cemetery; they did not reappear.

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A little before 8 a.m., General d'Amade came ashore at Koum-Kalé, and joined Colonel Ruef at his command post on the western outskirts of the village. On the report which he made to him of the situation, he ordered battle to be recommenced at once. A certain amount of confusion ensued, under cover of which a hostile detachment got possession of two machine-guns, and regained the cemetery. Another detachment crept into the village and occupied a block of houses where they barricaded themselves. The remainder laid down their arms.

It was first necessary to wipe up that part of the locality where the enemy had made a penetration. The reserves and section of sappers and miners surrounded it, and shortly the block offering resistance was carried. This operation entailed still further losses, amongst which was Captain Ferraro, commanding the engineer company, who was killed by a shot fired at point-blank range.

A fresh attempt on the cemetery developed. As a set off, our right wing, reinforced by the 4th company, had been improved along the shore so as to face the lines of trenches connecting the cemetery with Orhanié; a lull then was produced on the whole battle front.

At mid-day General dAmade went on board the battleship '*Queen Elizabeth*', the Headquarters of General Hamilton, whom he made acquainted with the situation at Koum-Kalé. The General Officer Commanding deemed that the mission of the French detachment was at an end. Accordingly General d'Amade, having returned on board the '*Jauréguilberry*', sent orders to Colonel Ruef to begin the re-embarkation at nightfall.

This order was somewhat late in reaching its destination. It did not get to him till about 5 p.m. Meanwhile the course of events had turned to our advantage. At about 3 p.m. the '*Henri IV*' and the '*Jeanne d'Arc*' reinforced by the '*Latouche-Tréville*', all three bringing their broadsides to bear in the Straits, had got the Turkish trenches between the cemetery of Koum-Kalé and Orhanié under their fire, enfilading them from the right, whilst the auxiliary cruiser '*Savoie*', which was in position in the Aegean Sea off Yeni-Chéir, cannonaded them from their left; lastly the section of 75-mm. guns, in battery on the beach, plastered them with explosive shells. Under this cross fire the field works soon became untenable. The defenders abandoned them. Part of them made a precipitous retirement inland; the remainder came in to surrender to the first battalion. Thus a capture of nearly 400 was made.

The re-embarkation under the enemy's fire was not a less delicate operation than the disembarkation. Colonel Ruef decided as soon as darkness set in to commence by the artillery, then to withdraw the infantry in two echelons to the cover of two positions in rear, the first marked by the outer fringe of the village, which was extended by a trench across the shore, the second utilizing the interior of the village in the neighbourhood of the fort, which was to form a redoubt.

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The guns and material were loaded without incident on the lighters which had brought them. The infantry commenced its movement at 10 p.m. The enemy made no attempt to disturb them. The heavy artillery of In-Tépé, alone, sent over several salvos on to the platform and beach. The projectiles, falling amongst the agglomeration of men massed on the shore, caused some casualties and produced a certain amount of confusion. The energetic action of Lieutenant-Colonel Noguès, who was himself wounded, and of the officers, rapidly restored order. The process of embarkation was thenceforward carried out without interruption; before day-break it was completed.

And thus was the diversion at Koum-Kaué accomplished, which had caused us serious losses[1], but which, to quote Sir Ian Hamilton, when he complimented and thanked General d'Amade, had 'admirably' achieved its object. The enemy after having shown a very keen front on the first day, and during the night, had afterwards lost heart, and was beginning to give way utterly, when the orders for withdrawal were issued.

This outcome was due to the judicious dispositions of the French commander, and to the bravery of our troops. The operation of the 25th and 26th April played a brilliant prelude to the eastern campaign which, after so many merciless ordeals for our troops, frustrated ambitions, and imperfect successes, was to culminate in September 1918 in the first break-through of the huge front held by our opponents.

[1] Killed: 6 officers, 170 men; wounded: 10 officers, 471 men; missing: 4 officers, 125 men. Total: 786, of whom 20 were officers.

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PRACTICE CAMP REFLECTIONS, 1921.

BY CAPTAIN A. W. G. WILDEY, M.C., R.G.A.

WE have just returned from Practice Camp. During the 'tactical' part of the proceedings some very instructive days were spent when infantry officers attended the practice and later joined in the discussions which followed the shooting. The impressions left in the writer's mind by these discussions have prompted these notes.

I.—The indication of targets to the guns by Infantry.

With the idea of finding out to what extent infantry officers could indicate to the supporting artillery particular targets on which they wanted fire, parties of officers were taken forward with Artillery F.O.O's and asked to write, in message form, instructions to engage certain specified targets. The country (Glen Imaal) is open and observation is easy; there are few reference points, but such as exist are for the most part easily described and were generally well known to the gunners. The problem therefore was set under fairly easy conditions. Yet even so, out of a large number of messages written, only one or two conveyed the information in such a way that the guns could make no mistake.

A study of the messages sent shows that roughly three different methods are employed in discribing targets.

(a) *The reference point method.*

The infantryman indicates the position of the target with reference to his own position, by moving progressively from one reference point to another.

Example :—

> "My position is in front line trench near single tree on Old
> "Mill Hill. 50 yards to my right front a small shack. Two
> "fingers left of shack a M.G. worrying my left platoon.
> "X. Rt. Coy. Comdr."

The disadvantages of this type of message are, firstly, it is a long message to send by morse; it is given from the point of view of the observer, and the directions may not be so clear to the recipient who may be unable to see one or more of the reference points; thirdly, 'two fingers' gives only a vague idea of the distance. An estimation in yards, though approximate, would be more valuable.

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(b) *The map-reference method.*

Example :—

"M.G. located 100 yds. N. of first L in Old Mill Hill. Ref. "O.S. Sheet 129. &c."

The accurate interpretation of this message depends on both sender and recipient being in possession of the same edition of the same map. This may not always be the case. It also depends on the accurate spotting on the map of both the reference point and the target. No easy matter always, especially on a small scale (1-inch or half-inch) map.

(c) *The 'Clock-face' method.*

The target is first located as accurately as possible on the map. Then two points on the map are chosen as reference points. One of these is taken to be the centre of an imaginary clock-face and the other to be on the 12 o'clock radius. The position of the target is then described as being so many yards along one of the hour lines.

Example :—

"Centre Leitrim Castle. 12 o'clock Engine House. M.G. in "gorse patch 1300 yards on 10 o'clock line."

There is again the disadvantage of having to refer to maps, though in this case it is not so essential that they should be the same maps provided they both show the two reference points.

The system might be modified by making the 12 o'clock line coincide with true or grid North. A further disadvantage is that it involves the use of some form of protractor, which may not always be forthcoming.

There are points of merit in all three methods.

The problem is to discover one that can be universally taught, and made the standard method for *all arms*, and introduced in the training manuals. In the September number of the R.A. Journal is described a system which has been used on the N.W. frontier. It is similar in principle to the third method described above, but in this case the 'Artillery helio, or some known part of the artillery' is taken as 6 o'clock and the observer is taken as the centre of the clock-face. The system might work well in hill warfare and open country, but would not be practicable in close country. What is wanted is a method which can be used in any type of terrain. Above all is wanted a short and well understood method of sending the information as a message.

Of the three methods of indication just described the first appealed most to the artillery subalterns as being the easiest to understand. This was possibly largely because the reference points were clear and well known to them, and they had a very shrewd idea of the target which was being described. In this respect it was hardly a fair test. They might not have been so happy in enclosed country.

One infantry officer proposed indicating the target by means of a small panoramic sketch, asserting that all subalterns could and should

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be trained to make them. There is little doubt that, well executed, a panoramic diagram is a very clear way of indicating a target, but an almost insuperable objection is that only a very few persons have a sufficiently developed sense of proportion and perspective to be able to make even the simplest sketch intelligible to anyone else.

The problem remains unsolved. There can be no doubt of the need of being able to indicate targets accurately and clearly by morse signal to the artillery. The writer is inclined to favour the clock method, in spite of its apparent disadvantages. It is at least methodical, and can be made a habit. Whatever system we adopt every officer must be throughly trained in its use. Above all it needs skilful map reading.

II.—Observation of Fire by Infantry.

After various messages had been written and criticised, one or other of the F.O.O's ranged on the chosen target; and when a few rounds had been fired the observer was made a casualty and an infantry officer was asked to continue the observation and correction of fire.

At first there was confusion due to doubt as to whether 'observations' or 'corrections' were being given. Later the infantrymen were asked to send corrections, which they did in yards, e.g. '50 yards more right', 'drop 100 yards' etc. At the discussion which followed battery commanders were unanimous in their opinion that observations in estimated yards should be the invariable rule and that during fire for effect 'mostly' observations should be given.

It seemed to be generally agreed that some definite system should be laid down by which artillery fire could be corrected by infantry officers. Whatever system is adopted it should be embodied in all training manuals and practiced at Camps.

Some of the shooting done by the infantry officers was not without humour: The spectacle of a war tried veteran, whose target was an enemy trench, dropping a fine fat six-inch shell plumb on the exact spot said to be occupied by the 'Right Company Commander' was greatly appreciated—especially by the Gunners.

III.—The indication to the artillery of the moment of the Infantry assault on an objective.

One or two of the tactical schemes set for solution involved the assault of an enemy position after a short preliminary bombardment or 'barrage'. In one particular case—a scheme demonstrating the action of a battery with a flank guard the position was supposed to be attacked by one company covered by the fire of the battery. The flank guard commander and the battery commander arranged that the actual signal for the assault would be 'an intense and unmistakable burst of fire' followed immediately by a lift of 200 yards. The infantry were to fire a Very light as a signal that they were ready to assault. Much discussion followed this. The objections raised to this method of giving the signal were :—

(i). It is not always possible to distinguish an intense burst of fire from all the other shelling that may be going on.

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(ii). It may not always be possible to indicate by means of Very lights, rifle smoke grenades or other signals that the infantry is ready, because in the smoke and dust of shelling the signal may be missed, or it may happen that no such means of signalling may be available when required.

One officer of high rank asserted that the only certain way was to order the assault for a definite hour, the artillery fire on the objective lifting at this hour. The objections raised to this were, that the infantry might be ready to assault long before 'zero', and that during the subsequent wait morale might suffer or a valuable opportunity be lost. Opinion seemed to be general that any form of visible signal (heavy burst of fire—smoke—rocket—Very light, etc.) would be too liable to misunderstanding or to failure for want of means, and could not be depended on, and that 'time' is the only sound solution of the problem.

Is there any doubt that for a simple trench to trench assault by troops already in position the only satisfactory method of co-ordinating the attack is to order a zero-hour?

In all other cases, that is to say, in all cases where the attack develops from a rearward position the control of the assault by time would not only be impracticable but actually prejudicial to success. For such advance, according to modern practice, is made, not by lines or waves of attacking infantry but by sections and platoons working forward by mutual support and making full use of ground, and it will seldom be possible to say at the beginning of the advance what positions the infantry will find themselves compelled to assault. Much will depend on what success the infantry will have in 'soft-spot' finding.

All that seems possible is to indicate a line to be passed by the leading troops at a given hour, after which artillery support must depend on the closeness of touch between the two arms and the efficiency of communications which will allow the infantry to indicate points that are holding them up. Once effective fire has been opened it must be continued for a definite period and only repeated if the infantry ask for it. Any form of stereotyped or 'Normal' support is out of the question. Normal situations don't occur in war; each position requires special treatment.

For this, perfection of communications is the first essential, and can only be ensured by continuous combined training of the two arms in peace. It is suggested that infantry battalion and company staffs with signal personnel should attend all 'tactical days' at practice camps and that the various artillery targets resulting from the tactical schemes set should invariably be communicated to the guns through the infantry exactly as they would be in war. And it is also suggested that battery and brigade staffs should attend as often as they can when 'battalion' and 'brigade' training is being carried out in order to make use of every opportunity for inter-communication.

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"SEVENTY-FIVE" VS. "SOIXANTE-QUINZE."

A Comparative Study of American and French Divisional Artillery.

BY D. A. GURNEY, MEMBER A.O.A.

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THE 75-mm. Gun Carriage, Model of 1897 (French), used by the French and American armies during the war, and familiarly known as the Soixante-Quinze, is quite generally reputed to have been the best type of field artillery weapon then in use. This favorable reputation is believed to be due principally to the fact that the hydro-pneumatic recoil mechanism used on this carriage was more reliable than the hydro-spring mechanism used on the British and German field carriages, and the single-trail axle traverse carriage is simpler to operate and repair and cheaper to construct than the split-trail type, as used on the Italian Deport and on our 75-mm. Gun Carriage, Model of 1916.

Aside from the manufacturing difficulties experienced with the recoil mechanism of this carriage, which are quite generally understood and have been discussed in detail elsewhere, the carriage proper is not an easy manufacturing proposition. This carriage was manufactured in this country in quantity during the war, and great difficulties were found and overcome in the manufacture of the trail, which is not of simple form, and in the manufacture of the rockers and operating mechanisms.

At the close of the war an attempt was made by the Westervelt Board to obtain a consensus of opinion of the artillery officers of the various countries as to what should constitute an up-to-date carriage for the light field gun. Opinion was not at that time definitely crystallized, but all the nations had experimented to a varying degree in trying to develop a carriage having greater elevation and increased range and a wider field of traverse. As a result of its investigations the Westervelt Board drew up specifications for an ideal gun which should be about 3 inches in caliber with a maximum range of 15,000 yards, a vertical arc of fire from minus 5 to plus 80 degrees, and a horizontal arc of fire of 360 degrees, and stipulated that if practicable the carriage should be designed to mount either the light field gun or the light field howitzer interchangeably. These specifications were accepted as the basis of the design of the 75-mm. Gun and 105-mm.

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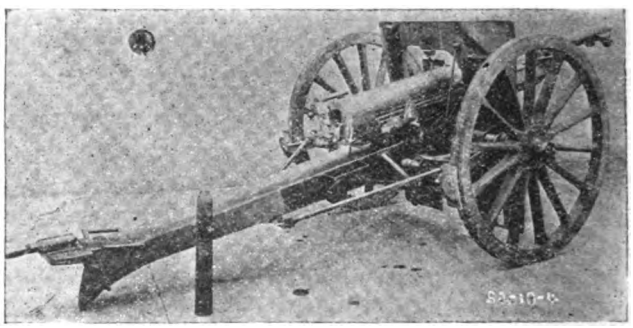
Howitzer Carriage, Model of 1920, which fulfills all the requirements of the Caliber Board specifications except for traverse, the total traverse obtained on this carriage being 30 degrees. The 360-degree traverse can only be obtained on a pivot mount, and seems impracticable for any conventional type of carriage to be drawn by horses. Four of these carriages, two mounting the 75-mm. field gun and two mounting the 105-mm. howitzer, have already been completed, and will soon be tested at Aberdeen. The total weight of the gun, carriage and limber is about 4,800 pounds, which is considered too great for this type of artillery.

As an alternate to the split-trail carriage above referred to, design of a single trail carriage, Model of 1921, for a 75-mm. gun of the same ballistics as the 75-mm. gun, Model of 1920, has been completed and one carriage is now under manufacture, which will be available for test this coming summer. This carriage has been designed with the idea of making it as light and as simple to manufacture as possible and it is expected that the total weight of the gun, carriage and limber behind the team will not be more than 4,000 pounds.



The French "Soixante-Quinze."

The gun is known as the 75-mm. Gun, M. 1920MII, is 42 calibers in length, fires a shell weighing 15 pounds to a range of 15,100 yards with a muzzle velocity of 2,175 foot seconds, this velocity being obtained with a supercharge. The normal charge for this gun will give a velocity of 1,500 foot seconds. The weight of the shrapnel is 17 pounds; the shrapnel velocity has not yet been definitely decided upon. The gun, of chrome steel, is provided with a breech mechanism of the horizontal sliding type, and weighs 945 pounds.

The recoil mechanism is hydro-pneumatic of the St. Chamond type, the length of recoil being constant—42 inches. Due to the fact that the elevation has been limited to 45 degrees, and due to the location of the trunnions, which are situated at the rear end of the cradle just in front of the breech, it has been found practicable to use constant recoil, thus reducing the size of the cradle materially as compared with the 1920 model, with consequent reduction in weight and greater simplicity. A spring equilibrator is provided underneath the

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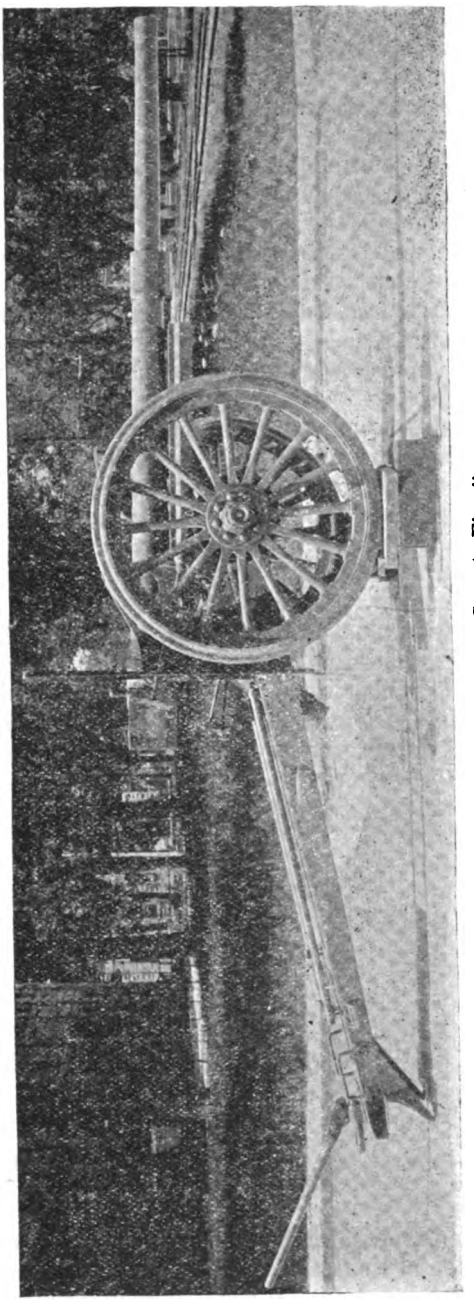

The New American "Seventy-Five."

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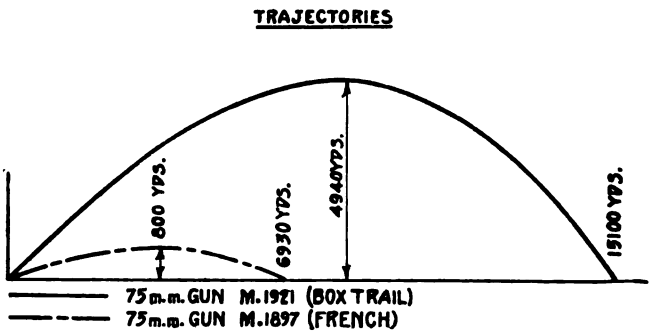
cradle, which is designed to overcome the unbalanced moment of the tipping parts, thus providing comparatively light handwheel loads. The carriage is provided with the independent line of sight, which is accomplished by means of rockers, one on either side of the cradle pivoted at the trunnions. These rockers carry large spur arcs at their forward ends. Pinions carried by the cradle mesh with these arcs, and are rotated by means of an elevating handwheel situated on the right side of the carriage near the range drum. By rotating this handwheel the carriage is brought to the proper elevation for range. A second pair of spur pinions mounted on a shaft located in the trail very nearly underneath the trunnions mesh with these same arcs. This shaft and pinions are rotated by an angle-of-site handwheel situated on the left side of the carriage. By rotating this handwheel the rockers are leveled when indirect aiming is employed or they are used to lay the sight on the target under the condition of direct fire. The standard panoramic sight is mounted on a bracket located on the left trunnion, and is provided with a cross level for correcting the azimuth error due to difference in level of the wheels.

The carriage is provided with axle traverse, which is obtained by shifting the front end of the trail transversely along the axle by means of a screw and nut operated by means of a traversing handwheel situated on the left side.

The axle is of simple I-beam section, except for the axle arms, which are of standard design. The wheels are 48 inches in diameter, having $3\frac{1}{2}$-inch solid rubber tyres. Standard 56-inch wheel hubs and standard spoke shoes are provided. The estimated weight of each wheel is about 230 pounds.



The New American "Seventy-Fize" has twice the range of the French "Soixante-Quinze."

The trail is constructed of 2 flasks which are of box section, the flanges being formed in such a way that no inside riveting is required. The flasks are perfectly straight from axle to spade, and are tied together near their front ends by the bracket which supports the angle of site pinions, and at their rear ends by the spade and tool box. Near the front end of the trail, triangular-shaped brackets for support-

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ing the trunnion bearings are riveted, and the trail is provided with the customary seats for the cannoneers who operate the elevating and traversing mechanisms. No axle seats are provided. Band brakes, operated on brake drums carried by the wheels, are controlled by means of a brake line, which extends to a point near the rear end of the trail and is operated through small cables by a cannoneer seated on the carriage limber.

The main shield is secured to the trail and to the brackets supporting the trunnions. A folding apron is situated underneath the trail, and a top shield, whose position is controlled by means of hinges operating on the automobile windshield principle, is provided. This top shield is so arranged that it may be folded down over the panoramic sight hood, thus permitting the use of aiming points throughout 360 degrees of azimuth.

It should be understood that although the 75-mm. Gun Carriage, M. 1920, as designed weighs about 800 pounds more than the expected weight of the M. 1921 carriage, a great deal of this excess weight can be eliminated by a proper redesign. The split trail carriage is really a carriage for the 105-mm. Howitzer, and it is estimated that by using the same gun and cradle as is used on the box trail type and limiting the elevation to 45 degrees, a split trail carriage can be designed having 30 degrees or more traverse whose weight will be not more than 300 pounds over that of the box-trail type.

A tabulation showing the various characteristics of the 75-mm. Gun materiel, Models of 1897, 1920 and 1921, follows :—

	75 mm. Gun M. 1897 (French).	75-mm. Gun M. 1920 (Split Trail).	75-mm. Gun M. 1921 (Box Trail)
Length in calibres	34·5	42	42
Muzzle velocity, shell, normal f.s.	1,805	1,500	1,500
Muzzle velocity, shell, super f.s.	—	2,175	2,175
Muzzle velocity, shrapnel f.s.	1,755	not determined	
Maximum range at elevation obtainable on carriage ... yds.	6,930	15,100	15,100
Maximum elevation possible ...	8°	30°	10°
Maximum traverse (total) on carriage	19°	80°	45°
Weight of shell ... ... lbs.	12·2	15	15
Weight of shrapnel ... lbs.	16	17	17
Normal length of recoil ... ins.	47	40—18	42
Weight of gun and breech mech. lbs.	1,015	1,242	945
Weight in firing position ... lbs.	2,887	3,600	2,800
Weight of gun, carriage and limber ... ... lbs.	4,411	4,800	4,000

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ARTILLERY *V.* AIRCRAFT IN SEMI-CIVILIZED AND SAVAGE WARFARE.

BY CAPTAIN L. F. GARRATT, D.S.O., M.C., R.A.

SEVERAL articles have recently appeared in the R.A. Journal dealing with this subject and one writer on the side of "Aircraft" even went so far in the May issue of the Journal as to leave one to infer that "mountain guns" now known as Pack Artillery were useless in a punitive expedition, and always had been, and that they should now be "scrapped" and the money so saved invested in extra aircraft appliances; also that the old form of punitive expedition had utterly failed to quell the turbulent races on the borders of our Empire. The latter remark is true up to a point, but only where the punitive expedition was followed by a subsequent withdrawal. Even here an exception may be found in the Gurkhas of Nepal against whom we fought in the 19th century and whom we subdued without any permanent occupation of their country Nepal; yet to-day we number them among the most loyal of our fighting troops in the Indian Army. In cases where our punitive expeditions have been followed by permanent occupation of territory we have almost invariably been successful. Our many Indian Frontier expeditions between 1864 and 1919 may be cited as instances of the failure of the "cut and run" policy. The Burmese Wars, the Sikh Wars, the Maori Wars in New Zealand, and the reconquest of the Soudan may be cited as successful permanent occupations of the last century in which the tribes were quelled by the addition of their territory to our Empire or by forming a protectorate over their country. By this latter means did our Empire gradually expand until it has reached its present limits. The key therefore to a permanent subjugation of turbulent tribes appears to lie in the permanent occupation of their country. This of course costs money and so has frequently, and especially of late years been ruled out except where such occupation would bring considerable commercial or financial advantage. In most punitive campaigns we have been successful in driving the enemy before us, occupying his country and destroying his crops cattle and villages, and then returned to our own frontiers again as soon as a fine of a few rifles had been levied and a promise of future good behaviour obtained. This causes him temporary annoyance and after a few months, or if the lesson has been a good one and a sufficiently large tribal dole has been given by us as a bribe, perhaps a few years, he is back at his old tricks again raiding and

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preaching Jehad. This was not the fault of the army or their tactics but of the government who had dictated the policy of these "cut and run" expeditions, since the supremacy of the civil administration over the military is a fundamental principle of all constitutional governments, and by the civil administration alone can "policy" in its wider sense be dictated. What the army had occupied they could have held had the government given the word and supplied the necessary men and money. Permanent or even temporary occupation of a territory can only be carried out by ground troops, infantry, cavalry, sappers and artillery, although their tasks and casualties may be considerably lessened by the co-operation of aircraft. Where cavalry or infantry go in any number artillery must follow, for the first duty of artillery is to give close support to the infantry, to prepare a way for them in the attack and to help them to hold what they have captured by breaking up the enemy's counter-attacks before they can reach our posts or line. In all these the infantry must assist with their own fire and in the case of concentrations of the enemy in nullahs low flying aeroplanes can render great assistance by dispersing them or by reporting the fact to the artillery. Costly in lives as were many of our punitive expeditions, how much more costly would they have been without the supporting fire of artillery.

Now the North West Frontier of India is a long one, the frontier mountains are barren, roads are few, the climate one of extremes and very dry and the tribesmen fanatical and semi-civilized; yet they are armed with many of our most modern rifles and ammunition and have their own ammunition factory in tribal territory. They have no guns worthy of the name. Now because of this lack of roads and because of the nature of the country the only form of artillery that can quickly pierce their mountain fastnesses in the wake of the advancing infantry, who are indispensable even to-day in these punitive expeditions, has been Pack Artillery for the reason that it is entirely mule transport and self contained and can go wherever the infantry ration mule can go and almost wherever the infantry soldier can go. Therefore, on the North West Frontier of India, Pack Artillery are always likely to hold their own against aircraft or any other innovation. Landing grounds in the hills are few and far between and aeroplanes could not be used to replace artillery in the close support of infantry, and could not remain continually in the air to repel hostile counter-attacks without interfering with their other duties, nor would they be suitable for this kind of work at close quarters in hilly country.

The author of "Savage Warfare and the development of Modern Weapons" in the May number has tried to excuse the failure of aerial bombing on the North West Frontier in 1919 on the grounds that no new weapons or tactics have "cut much ice" the first time they were tried; yet never has a new weapon such a good chance of decisive success as when it is first tried on the enemy for the reason that the enemy is generally taken by surprise and has no counter-measure ready. The greatest chance that the Germans had of gaining a decisive success with "gas" was in April 1915 when it came as a surprise to us and we

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had no counter-measures. Our greatest chance of success with "tanks" was for similar reasons in September 1916 when we first used them in battle and again in November 1917 at Cambrai when we employed "new tactics." Did not Napoleon's revolution in military art bring him decisive success at once. Did not the manœuvre of "breaking the line" of the enemy's fleet in the old days give immediate success the first time it was employed. Every new manœuvre in war is most likely to succeed when it is first employed, always provided that the enemy has no fore-warning and this is doubly true when the manœuvre or weapon depends on moral effect for its success and when the invention is made in wartime, as the enemy then has usually no chance to study it before it is tried on him. Similarly the greatest chance of an aerial success against the tribesman of the North West Frontier was when we first used aeroplanes against him. He might have turned and fled in panic thinking they were some holy visitation for his sins; but he didn't; he was made of sterner stuff; his first thought was what can I do to hurt them and he fired at them with his modern rifle and when the first aeroplane made a forced landing in his territory he discovered that they were very vulnerable; he also discovered that there was a large reward for every pilot or observer whom he returned safely to the British lines; so aeroplane "potting" became a remunerative sport as well. During the hot weather of 1919 it was found practically impossible for pilot or machine to remain in the air during the greater part of the day owing to the intense heat. The climate is not likely to alter and the Indian sun even at 12,000 feet can be merciless in June. Improvements for cooling both pilot and engine may be introduced but the air currents and disturbances and the natural features of the country will always remain. If we are to retain the initiative we must be ready for operations in the hot weather and it is generally during the hot season that the turbulent tribesman or the Afghan likes to catch us unawares if he can. In the hills of the North West Frontier there are few places where a forced landing will not mean at least the wreck of the machine.

Let us now pass to the use of aeroplanes during the Afghan war of 1919. In bombing Kabul their effect was moral but perhaps no more so than would have been the bombing of Berlin during the Great War. Again in machine-gunning concentrations of tribesmen from the air the effect is more moral than material; from the steep angle of descent of the bullets and the small portion of the human target exposed the material effect is less than a similar number of bullets fired from the ground would produce with their flatter trajectory against the same target at a longer range.

Let us pass again to the preliminary aerial bombardment of recalcitrant Wazirs and Mahsuds at the end of 1919. Some of the tribes came in certainly but the stouter ones resisted, and it was only when troops with guns were despatched against them that they were subdued—if we can say that they are yet subdued. At the moment we have occupied part of their country and instead of the old policy of withdrawal we are building roads and opening up the communications

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of the country, using the tribesmen themselves to assist us where they are willing. The tribesmen soon got used to the aerial bombardment of their villages and put sentries out to watch for the approach of aeroplanes and scattered on their approach or else they retired to caves in the hills; they were inconvenienced but no more so than a civilized enemy on the Western Front probably a good deal less as they have few permanent "tangible aerial objectives." In civilized warfare some of the best targets offered to the airman are the enemy's communications, roads, railways, transport columns. The turbulent tribesman has none of these. But for the shells of the artillery there could be no watcher. No man knew the hour of their arrival.

Familiarity breeds contempt and the chance of the aeroplane against the North West Frontier tribesman has gone; the same may be said of the Arab tribes of Mesopotamia. The aeroplane alone can never quell him unaided by other arms, or cause him more than temporary inconvenience. It can bomb his villages but there is a "Bolshevik" movement afoot among the tribes and tribal villages are easily rebuilt; even if the village elders counsel peace the younger generation will not listen; they have the rifles, stolen at considerable risk to themselves, and the man with the rifle is the man who has the say and so they defy their elders and continue the war. These young "bloods" have got to be sought out and killed, or starved into submission or discredited among their neighbours before peace can come. The inevitable punitive expedition with guns steps in once again but this time it does not immediately withdraw. In tribal warfare it is generally during our withdrawal that the enemy inflicts most of our casualties on us; aeroplane co-operation in the future may lessen these by spotting ambushes and bombing concentrations of the enemy. Doubtless where communications exist fast tanks and armoured cars will play a very effective part with the other arms in quelling turbulent tribes, but wherever infantry have got to go guns will still be required to follow either on motors or on pack animals or on wheels.

There are three methods of fighting the tribesman :—

(1). To kill him, i.e., exterminate him or show him you are top dog.

(2). To destroy his crops, cattle and villages, to disarm him and to occupy his country, i.e., to starve him.

(3). To make him look ridiculous in the eyes of his neighbours and of his women, i.e., to discredit his cause utterly.

All these can best be carried out by the co-operation of all arms. No one arm can manage it single-handed. As regards (3) much might be accomplished by the use of gas shell. If Abdul Haji Razak and other scallywags returned from battle to their villages a mass of "mustard gas" blisters, crying their eyes out with lachrimatory gas, and had to have their blisters dressed by their wives it would do much to damp their military ardour especially if they were too sore to sit down for a day or two, and would cause much amusement to their neighbours who would however take good care to see that no one tried

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the experiment on them; it would take them a long time to invent any anti-gas measures and the sight of a tribesman in a gas mask would be certain to arouse the mirth of his neighbours. On the other hand there are undoubtedly strong political reasons why we should not use "gas" against semi-civilized tribes and savages. There at least they have the whip hand over us as their methods of warfare are governed by no political considerations.

Against the "savages" of Central Africa aeroplanes might doubtless obtain the necessary moral effect at first, but even against them it would probably wear off after a time and the local witch-doctor would think out some charm against their moral influence. The recent success of aerial bombing against the mullah in Somaliland has been put forward as a claim that the effect of all other arms in semi-civilized warfare is far surpassed by the aeroplane. Is it not possible that the aeroplane put the finishing touch to the wearing down process of our other expeditions and that the tribes were already getting tired of the mullah before the aeroplanes arrived, and were only awaiting a reasonable opportunity to desert him.

Even in civilized warfare pack artillery has its uses; it was successfully used in Salonica, Palestine and Mesopotamia; it would have been equally useful at times in Italy. It can move over country denied to other forms of artillery and is easily concealed. There has been talk since the war of an infantry gun; if one ever comes into general use in our army it is likely to take the shape of a heavy pack artillery gun.

During the last ten years the fire power of the pack artillery has increased enormously. The new pack artillery 3·7-inch howitzer H.E. with a 106 fuze has caused havoc both moral and material on the tribesman of the North West Frontier, and doubtless some day when money is available an improvement on the 2·75-inch gun will be issued with increased material effect. Since the middle of 1919 six-inch howitzers have been used in action on the North West Frontier.

Aeroplanes may claim much but they cannot claim to have ousted pack artillery or any other form of artillery either in civilized or uncivilized warfare. Perhaps in primitive savage warfare, in which guns have never played a great part, they may be successful alone, and even then they require troops to protect them at rest and good communication for their parks and stores; can these latter be found in the African bush or in places where the real savages of the British Empire live? here again it may have to be the foot soldier or the gunner to the rescue.

Now that the "Great War" is over the centre of unrest has moved to the Middle East, to the Black Sea, to Palestine, Mesopotamia and the frontiers of India. At least the Imperial General Staff cannot think that the days of Pack Artillery are over, or why should they be organizing them now as they were never organized before and re-arm a large proportion of them with the 3·7-inch howitzer. In the land of hills, no roads and in desert places—and such country as this may be found in abundance in the Middle East—they are still indispensable, but by carrying out their proper rôle as the eyes of the commander

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and of the artillery and by replacing long range guns by distant bombing against suitable objectives, and by machine gun action, the aeroplane can do much toward decisive victory, but only by close co-operation with other arms. Doubtless by dropping ammunition and provisions aeroplanes can greatly increase the power of resistance of small besieged garrisons, but the relieving column will still be necessary in the end although disaster to the garrison may be saved by the aeroplane. It is as useless for the aeroplane to attempt decisive victory alone as it is for the navy to expect permanently to capture or silence a fortified harbour by bombarding it without sending in a landing party afterwards to occupy it. As regards the permanent settlement of the turbulent tribes the "forward" policy of occupation appears at least to give one solution and to be backed by history. Naturally there are few inducements to the permanent occupation of tribal territory on the North West Frontier of India some of which is the most barren country in the world; on the other hand the opening up of their country to trade and the employment of the inhabitants where possible by the government, the former of which will be bitterly resented at first, may do much in the end to ease the economical situation of their country and so remove one of the chief stumbling blocks to a permanent settlement. Here again unless we push the new frontier far enough forward to make it co-incident with the frontier of a peaceful people we shall still be faced with the same problem, although the turbulent tribes of the old frontier may be subdued. Then again it has been proved over and over in history that the peaceful people of to-day may not be the peaceful people of to-morrow, hence one great power is generally loth to swallow up the buffer state which divides it from another unless it has designs of aggression on the latter.

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INSTRUCTIONS FOR GUIDANCE OF OFFICERS JOINING INDIAN PACK ARTILLERY.

BY MAJOR H. E. KENYON, D.S.O., R.G.A.

A large percentage of officers are at the present time being appointed to Indian Pack Artillery with no previous experience of that branch of the Regiment.

In many batteries the Battery Commander is the only officer with previous experience.

To help my officers I drew up the following instructions as a guide and they tactfully said that they found them of the greatest use.

Other Battery Commanders probably have other ideas, but it occurs to me that such instructions may be of value, based as they are on 10 years service with Mountain, and Pack Artillery, and if they serve as a guide, or basis for constructional criticism, they have served their purpose.

Instruction 1.—Stable Management.

On returning from parade the following will be the normal procedure :—

1. Order mules to water.
2. Drivers form up ten yards from trough, in sub-sections.
3. Drivers (a) loosen girths, unfasten breast-piece and remove bits.
4. Move up to trough under orders of Section Commander and water.
   Note. See that *all* mules have their heads up before ordering away. Some mules are slow drinkers, it is the last drink that counts.
5. Drivers take mules to stables, remove head-stall, breast-piece, breeching and crupper, and hang them up. Don't throw them on the ground to get dirty.
6. Break off till time ordered for stable parade.
7. *Stable Parade.* Drivers fall in with rubber, brush and curry-comb in their hands. *Note.* This enables you to check any missing.
8. Turn into stables and carry out in the following manner :—
   (a) Clean mouth, nostrils, eyes and ears.
   (b) Undo girth, hand rub under girths (first off-side, then near-side), this should be done with the whole of the fore-arm.

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(c) Remove saddles and blankets. Spread out blankets and stand saddles on them, with the serge facing the sun, and lay headstall, girths, breeching, etc. on the blanket.

(d) Pat shoulders vigourously, to restore circulation, first off-side, then near-side.

(e) Groom body. First dry with rubber, then brush *hard*. Slack grooming is useless and bores the driver. Real hard grooming is nearly as good as exercising. Don't forget to groom under the dock.

Note. All above must be ordered by Section Commanders and not be left to individual drivers.

(f) Drivers will report to their Naiks when their mules are clean. Section Commanders will turn out the driver at once if satisfied.

(g) Driver goes to his harness for 10 minutes to clean it, then takes it to the harness room.

9. Salutri will inspect all mules and farriers inspect the feet.

10. Stables without system is deadly dull for all, and useless. With system all ranks take interest. It is very liable to deteriorate but energetic section commanders can keep it going. Remember that fire discipline may be perfect but, if your mules are not fit, your section is useless.

Always attend stables and *keep moving*.

Instruction No. 2.—March Discipline.

1. Before marching off see—

(a) That all loads ride evenly.

(b) That the blanket does not press on the withers.

(c) That there is an airspace between the saddle and the blanket.

(d) That top loads are well girthed up.

(e) That side loads are normally girthed; if properly packed, girths need not be tight.

(f) That the breast-piece and breeching are loose and in proper position.

(g) That the crupper fits properly.

(h) That nothing projects at the ends of the loads that is likely to damage the mule.

(i) That the loads themselves are well strapped up, and the ends of the straps properly secured so that they will not come loose and hang down.

(j) That the Gunners are properly distributed along the mules on either side.

2. On the march see—

(a) That Drivers keep to the right of the road.

(b) That Drivers lead with *both* hands.

(c) That Gunners remain in their places, and do not wander out into the road, or collect in parties. It is

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easier for them, but not fair on the Drivers, who must cover off: also the Gunners will not see if loads require adjusting.

3. If a load shifts to one side, it is forbidden to try and pull it straight. This creases the blanket, strains the mule, and the load will very soon shift again. Take the mule to a flank, so as not to block the way, take off the load and undo girths. Straighten saddle, load up and follow Battery as fast as possible, but do not *trot* up. This also makes all ranks more careful to see that loads are properly put on before marching off.

4. There should be no trotting on the march. If Drivers keep their proper distance, the *whole* Battery can march at a walk at the rate of one mile in 16 minutes. Lazy mules must be hustled by the Gunners in charge of them and the Drivers behind.

5. At every halt the B.C. orders the length of the halt—see that this is passed to each No. 1—let the men fall out at once.

6. At every halt, go round all your mules, and look particularly for girth and crupper galls: re-adjust any saddles that are working forward. Wither galls are most serious, lay a mule up for a month or more, and should never occur if breeching and crupper fit, and are properly adjusted.

Driver Havildars similarly inspect their sub-sections, and each Driver his mule, and report to you as you come round.

As soon as you have inspected, report up to the O.C. that all mules are correct, that so many loads want re-adjusting. If all are ready before the order to march has been received, report your section ready.

7. At halts, all men fall out to the right of the road: the road is then left clear for other traffic, and reports and orders can then be quickly passed up the Battery.

8. You are given a horse to ride because you cannot superintend your section on foot. You must be continually up and down your section seeing that Drivers are leading properly, that mules are closed up, that Gunners are in their places, and that loads are riding properly.

A good plan is to have your horse at the rear of your section. March off at the head of your section, and after five minutes let your section gradually pass on. Then get on your horse, and ride slowly up again, and so on throughout the march.

9. If you have to give an order to someone in rear, or want to give an order to someone in rear, when on the march, *do not go back*. Stand still and wait till the individual comes along.

10. Do not forget to tighten up breast pieces going up a steep hill, and to slacken off breechings. Vice versa when going down hill. Well trained Drivers will do this without an order, but see that it is done. This can be done without halting.

11. When passing obstacles where men are likely to check, remain at the spot till all have passed, and allow no checking of pace that can possibly be avoided.

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12. Never let men hang on to saddle to avoid getting their feet wet; think of your mules.

13. If the march is very dusty, and you halt near water, make the Drivers wash out the mules eyes and nostrils. This refreshes the mules enormously.

14. Never allow Gunners or Drivers to hang their rifles or swords on the loads, or to hang on to the mule in any way themselves.

15. When watering from ponds, do not allow the mules to walk in the water. This stirs up the mud, and the next lot of mules won't drink properly. At running water, water mules above horses.

Instruction No. 3.—Notes for Drill.

1. SILENCE. Absolute silence to be maintained except for those giving orders. Failing this, orders will not be heard, or will be heard incorrectly.

2. Orders given by Nos. 1 affect their sub-sections only. Nos. 1 should therefore only give their orders loud enough for the Section Commander to hear that it is correct.

3. Section Commanders and Nos. 1 are responsible that orders are received by the next Section Commander or No. 1.

4. Section Commanders must train themselves to watch all that goes on in their Sections, but they must keep an ear open for any orders that may be passed down by the B.C. They are very apt to get so impressed with something at the gun, that they forget the B.C. who may have to pass down a fresh order.

5. Don't let men get up unnecessarily on the order "Prepare to limber up" or "Cease Fire." The majority of the work can be done kneeling. Keep your men down. You don't want the enemy to know you are going to move. If he does, he will probably give you a concentrated "hate" and you will loose valuable men and animals, and may be put out of action.

6. Make the Drivers bring their mules up to the right place. Gunners should not have to carry loads more than a mules length when limbering up.

7. In unlimbering top loads, Gunners give a straight lift, and Drivers *at once* lead mules away. Forbid your Gunners stepping back with loads; they may step over a khud.

8. Directly a top load is on, strap it up tight *at once*, otherwise a nervous mule or a frightened one may throw it off again, damaging either the load or the personnel.

9. Insist on "straight arm" lifts always—forbid "sliding" loads on to the saddle, or throwing them on. It is not smart, and may damage the equipment and mule.

10. See that Drivers move away directly the load is on or off, and do not stand about the position getting in the way, and giving it away. Normally they move off at a trot, unless this raises dust. See that your Driver N.C.O's hustle both Drivers and mules. The latter learn very quickly.

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11. If a mule is fidgety loading up, a Driver N.C.O. should hold up a fore-leg. See that he lets it go directly the load is on the mule's back, and that straps are secured at once. Do not let your Gunners chase a mule all over the country, carrying a load. Bring the mule to the Gunners. (See note below).

12. Do not have nervous and fidgety mules in your firing battery.

13. Provided he has good bone, the smaller the top load mules are the better.

14. Para. 4 above is particularly important when limbering up or unlimbering. Keep an eye and ear open for the B.C. and for the other Section Commander.

15. You cannot do everything yourself. Train your subordinates to do their full share, *and see that they do it.* If they don't, get rid of them before they let you down. Make them assert their authority, and exercise their responsibility.

NOTE.—The following method of attaching the rein to the bridoon bit may be adopted to gain more control over restive mules, and to prevent mules stampeding when under fire :—

1. Pass one of the T's of the rein through the near ring of the bit from inside to outside.

2. Pass the other T of the rein through the off ring of the bit from outside to inside, and then through the near ring from inside to outside.

3. The rein can now be used in the ordinary way.

4. If it is required to restrain a restive mule, or it is apprehended that a mule may be frightened by coming under fire, or otherwise, pull the T of the near rein, then pulling the rein through the near ring of the bit, pass the loop of the rein round the mules nose, and haul fairly taut.

5. The rein is now single in the Drivers hand, and, when hauled on, compresses the mule's nose, and stops him.

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THE PROMOTION OF SENIOR CAPTAINS OF THE R.G.A.

BY CAPT. W. H. G. DRAKE-BROCKMAN, M.C., R.G.A.

IT is now four months since this question was drawn attention to in the R.A. Journal, and the position of these Officers as regards promotion is the same (only four months worse.) No promotions have been made, nor has there been any official notification as to any chance of promotion in the immediate future.

If we take the R.A. Seniority and Distribution Lists of August, 1914, and January, 1922, and eliminate those who appear to have been "passed over" and only take normal cases, we find the following data :—

R.F.A. AUGUST, 1914. R.G.A.

Years of Service.	Minimum for Promotion.	Rank.	Years of Service.	Minimum for Promotion.
$28\frac{1}{12}$ - $31\frac{10}{12}$	26 (14)	Lieut. Colonel.	$28\frac{6}{12}$ - $33\frac{6}{12}$	$27\frac{10}{12}$ (38)
$17\frac{5}{12}$ - $28\frac{1}{12}$	$15\frac{1}{12}$ (3)	Major.	21 - $28\frac{6}{12}$	$18\frac{5}{12}$ (16)
13 - $17\frac{5}{12}$	$5\frac{1}{12}$ (1)	Captain.	13 - 21	$4\frac{4}{12}$ (79)

R.F.A. JANUARY, 1922. R.G.A.

Years of Service.	Minimum for Promotion.	Rank.	Years of Service.	Minimum for Promotion.
22 - $24\frac{4}{12}$	$20\frac{2}{12}$ (3)	Lieut. Colonel.	$24\frac{10}{12}$ - $28\frac{8}{12}$	$24\frac{4}{12}$ (57)
$12\frac{6}{12}$ - 22	$9\frac{1}{12}$ (365)	Major.	$17\frac{6}{12}$ - $24\frac{10}{12}$	$14\frac{2}{12}$ (284)
$7\frac{3}{12}$ - $12\frac{6}{12}$	$3\frac{2}{12}$ (269)	Captain.	$6\frac{10}{12}$ - $17\frac{6}{12}$	$2\frac{9}{12}$ (332)

NOTE.—The figures in brackets refer to the seniority numbers of actual officers.

From the above it will be seen :—

(1). In the case of Lieut.-Colonels, whereas before the War, the junior Lieut.-Colonels of each branch had approximately the same service, the R.F.A. have gained, as regards minimum service for promotion, nearly $2\frac{1}{2}$ years. But on the other hand they have to retire earlier on the four years rule, and thus lose in pension as regards the service increment.

(2). In the case of the Majors, whereas before the War, the senior Major of each branch had approximately the same service, the senior Major R.G.A., has now nearly three years more service than the senior Major R.F.A., and the R.F.A. have gained, as regards minimum service for promotion, $1\frac{9}{12}$ years. But Majors are protected as regards

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promotion, to a certain extent, by the four years rule for Lieut.-Colonels, and again the R.F.A. Major on promotion will be the loser in pension as regards the service increment.

But in the case of Captains, the situation is very different.

Since the introduction of the four years rule for Lieut.-Colonels, there have been no promotions for Captains either in the R.G.A. or R.F.A. This practically means that the four years rule has only been introduced to absorb supernumary or extra Majors, and that Captains in both branches will not feel the benefit of it until many years have passed.

We may assume, therefore, that promotion as regards Captains in both branches will be at a standstill for many years to come.

Let us now compare the position of the senior Captains in the R.G.A., and the junior Majors in the R.F.A.

(1). Before the War, the senior Captain, R.G.A., had $3\frac{1}{2}$ years more service than the junior Major R.F.A., whereas now he has the great difference of five years more service. In other words, the War has left him $1\frac{1}{2}$ years worse off.

(2). There are at present 73 R.G.A. Captains with over 13 years service, who would have been Captains by Royal Warrant before the War, and therefore they have gained nothing whatever by the War, as regards promotion in rank. On the other hand, there are at present 14 junior Majors R.F.A., with less than 13 years service who would not have been Captains before the War, but have now actually been substantive Majors for over three years.

(3). One of the junior Majors, R.F.A., was promoted Major in the minimum of $9\frac{1}{12}$ years ($3\frac{11}{12}$ years before he would have been promoted *Captain* in peace time) and one of the junior Majors, R.G.A., in the minimum of $14\frac{2}{12}$ years, a large difference of five years, whereas, taking similar differences in years of service among the junior Lieut.-Colonels and Captains of the R.G.A. and R.F.A., we have only $4\frac{2}{12}$ and $\frac{5}{12}$ years respectively.

(4). On February 2nd, 1922, there will be a junior Major R.F.A., who after five years service as a substantive Major, will draw an additional 5/- a day, making 36/6d. per diem in all. This Officer Commissioned in July 1906, has less years service than each of the first 43 Senior Captains, R.G.A., who will only be drawing 26/- per day. Furthermore, in June, 1922, 6 junior Majors, R.F.A., commissioned in July, 1907, will draw 36/6d. p.d. after five years as substantive Majors, whereas in the R.G.A., there will be six senior Captains also commissioned in July, 1907, who will be drawing only 23/6d. p.d., not having completed 15 years service.

(5). Apart from ordinary pensions, there is, under the new scale of pensions for widows and children, published in Army Order 432/1921—Table II, some considerable difference between those of Captain and Major, especially as regards paras. (2) and (3).

(6). When Armament Pay was done away with under Army Order 324/1919, it was hoped that the amalgamation of the two

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branches would shortly follow. But as it is generally understood that this will not take place now, the R.G.A., in comparison with the R.F.A., are faced in addition with the fact that they have lost their Armament Pay through the War.

(7). There are at present 80 Captains, R.G.A., with service dating from July 1904 to July 1909, who, if they have not done so, will have to pass their promition exams to Major (a rank which the majority held for some years in the Field) whereas there are 145 junior Majors, R.F.A., of the same service, who have never had to pass for promotion to Major.

From the above, it will be seen that the relative positions of senior Captains, R.G.A. and junior Majors, R.F.A., is very unsatisfactory. It must be recognised that, as a whole, the senior Captains, R.G.A., and the junior Majors, R.F.A., carried out the arduous duties of Battery Commanders during the late War and as it would be invidious to draw any distinction between the R.G.A. and the R.F.A., as regards the work done or risks run, the work of these Officers, as regards battle-honours, must for ever stand equal. To the Infantryman, during the War, a gunner was just a gunner, whether R.G.A. or R.F.A., and one would have thought that a battle-honour such as the third Battle of Ypres, known as the "Gunners' Hell" would have left the regular Battery Commanders, who in the battle were, to all intents and purposes, R.A., and not R.G.A. or R.F.A., not only equal in honour, but also in rank, pay and promotion.

As the situation now stands between senior Captains, R.G.A., and junior Majors, R.F.A., the former are left, after the War, with a genuine grievance as regards promotion and they have in addition to be in immediate touch at times with junior Majors, R.F.A., who, although their senior in rank now are many years junior in service and years.

This situation is very unsatisfactory, and unless definitely improved, may cause considerable feeling between these two ranks and make a still wider breach between the two branches of the Royal Regiment.

As regards the cause of this large discrepancy in the status of these Officers, the reason would appear to be that too many *substantive* Majors were made during the War, in the R.F.A., whereas they should only have been given *acting* rank, as was the case with their *confréres* in the R.G.A.

The responsibility for this substantive promotion naturally rested with the highest authorities, and the present general feeling among senior Captains, R.G.A., is bound to be that "the R.F.A. were in power during the War, and naturally tried to get as much substantive promotion as possible.

In addition, in the case of the R.G.A., until the formation of R.G.A. Batteries into definite Brigades during the winter of 1917/18, the R.G.A. Battery Commander was to all intents and purposes "nobody's child" sometimes having as many as ten different Colonels or Corps H.A. Commanders in the course of a year, with no one in

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higher authority of any permanent order to look after his interests, promotion or rewards.

As regards the solution, that again can only come from the highest authorities, who appear to have been responsible in the past for the present situation, and as it is assumed that the matter which involves many considerations is receiving serious attention, the writer does not presume to offer a solution.

But if there is to be no solution, and the promotion of senior Captains, R.G.A., is to remain at a standstill for some years to come, would it not be possible for the highest authorities to make some official pronouncement as to their chance of promotion. All the records of the *bases* on which the promotions in the R.F.A., and R.G.A., during the War were made, are surely still available, and if an official explanation could be given, showing that the present position of senior Captains, R.G.A., in relation to junior Majors, R.F.A., is justly inevitable, such explanation would do a great deal to allay the daily anxiety of these senior Captains, and especially if the explanation embraced some definite prospects for them in the future.

In addition, there are all the present rumours attached to the economies to be effected by the "Geddes Axe". It can only be hoped that the highest powers that be will see that when the Axe does fall, the edge will be taken off on the Civil Servant *first*, and not on the soldier and sailor who had to face the hardships of the War with their lives, and in most cases at a much smaller rate of pay than the Civil Servant.

One rumour is that Captains are to go at 38 and Majors at 45. If correct, then the senior Captains, R.G.A., will be very badly hit, for rumour also has it that there will be no promotion for them for at least five years. If so, then most of these Captains, will be forced to go on pensions barely over £200 p.a. to swell the ranks of the unemployed, while many junior Majors, R.F.A., junior to them in total service, will be able to serve on to 45 and make pensions of over £400 p.a. besides getting on an average 10 years full pay in addition. Such a state of affairs would even remain a blot upon the records of the Royal Regiment, whose motto is "Quo fas et gloria ducunt". It is only in the case of this particular rumour proving true that the writer can venture to offer suggestions. That if Captains have to go at 38, those who have been acting Majors during the War should receive pensions as though they had been made *substantive* Majors since the dates on which they were originally made *acting* Majors and receive a suitable gratuity in addition. But if Public Funds cannot run to this expense, then let justice and economy take effect together. If there has been a mistake in the past in making too many substantive Majors R.F.A., then let that mistake be confessed to, and those junior Majors R.F.A. be treated as though their *substantive* rank had really only been *acting*, and be "demoted" to a seniority as Captain more in keeping with the merits of their "opposite numbers" in the R.G.A.

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MECHANICAL TRACTION V. HORSE DRAUGHT.

BY MAJOR J. N. DIGGLE, D.S.O., LATE R.A.

IN the "Duncan" Commended Essay by Capt. F. R. G. Milton, M.C., R.F.A., in the Journal of the Royal Artillery of October 1921, there is certain matter which I beg to correct.

The author of the above Essay says that an "Experiment with Erhardt Guns behind tractors in 1913 showed that the carriage could not stand up for 20 miles at 20 miles per hour."

I was Adjutant of the battery which performed this experiment 19th July, 1914, and not in 1913.

I am convinced, that had this experiment been tried earlier, great alterations in traction for guns of all calibres, would have been made both before and during the earlier period of the war.

Lord Plumer watched the experiment from a War Office point of view and was much struck thereby; but I believe his report did not reach the higher authorities before the beginning of hostilities.

By request of the Secretary of R.A.I., I was making out a description of the experiment with photographs and drawings when the superhuman efforts required from a Territorial Force Adjutant on mobilization put a stopper on it.

What actually happened was this, 4 Erhardt Guns and 8 Waggons were drawn 89 miles at an average speed of 21½ miles per hour, from "Start Engines" to "Action" including time for "Prepare for Action." A half-hour spent half way, for inspection by Lord Plumer is not taken into consideration (the last 3 miles from "Prepare for Action" to "Action" were covered in 6 min.)

The wheels, the only part of the equipment manufactured in England gave no trouble whatever. They had been soaked in the Kennel Pond for seven days and the lubricant was graphite and oil.

The only real casualties were to the brake arms, all of which were broken, not for the first time. The rocking bar sights, which were carried in boxes on the chassis were tested after "Action", also after the return journey, and were correct for deflection, and not more than 10′ out for elevation, which was usually a small error after a day on the ranges.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—January, 1922.

I. Operations of the Belgian Army 1914-1918. (Continued).
II. Security on the march. Maj. Requette.
III. Belgian and French Aviation on the Western Front during the War. Cap. Comdt. Desmet.
IV. Scientific organisation and Chemistry as aids to victory (II). Dr. de Sillevaerts.
V. Mobilization of the Nation for War (III). Cap. Comdt. Dendal.
VI. Directional Wireless and its application. Cap. Comdt. Tricot.
VII. Grenades. Cap. Comdt. Paquot.
VIII. Notes on Foreign Armies.
IX. Arms and Services.

France.

Révue Militaire Générale.—December, 1921.

I. The dislocation of the Russian Front. Général Martchenko.

An interesting if depressing account of what was happening on the Russian Front after the revolution is given in a book "Du Double Aigle au drapeau rouge" edited in Berlin 1921 by Mme. Olga Diakow. This article quotes three episodes from the above book showing what wild beasts the uneducated soldiers became once discipline had been destroyed.

II. The recasting of regulations and our war teaching. (Continued). Lucius.

Deals largely with Nivelle's offensive in 1917.

III. Comparison of Infantry Fire Tactics before and after the war. (Part III.) Capt. Laffargue.
IV. Strategy and Operations. (Chapter V.) Capt. Kuntz.
V. Employment of Artillery II. Maj. Pamard.

Revue d'Artillerie.—Jan. 1922.

I. Accompanying fire of field artillery. Capt. Rolland.
II. The artillery at Les Eparges. Lt.-Col. Mussel and Maj. Olry.

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III. The maximum range attainable from a gun of given length. Maj. Maurin.
IV. Evolution of the organisation of the German Artillery during the war. (Extract of a study made by the General Staff.)
V. On series with time fuzes. Capt. Courbis.
VI. Employment of artillery in Morocco. (Continued). Maj. Canova.
VII. The German Firing Manual of Dec. 4. 1919. (Continued).

Switzerland.

Revue Militaire Suisse.—December, 1921.

I. The Reichswehr—its formation and rôle. Maj. de Vallière.
II. Rapidity in attack, during and after the great war. Jean Fleurier.
III. *Foreign News.*—General Humbert and the Maroccan Division in 1914.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

The Battle of the Falkland Islands. Before and After. By Commdr. H. Spencer-Cooper. London, (Cassell), 1919.

The War of the Future. In the light of the Lessons of the World War. By General von Bernhardi. London (Hutchinson).

1914: Les Erreurs du Haut Commandement. By General Percin. Paris (Albin Michel).

Costing for Manufacturers. By W. Howard Hazell. London (Nisbet) 1921.

First Principles of Tactics and Organization. By Lt.-Col. J. L. Sleeman. London (Gale & Polden) 1919.

Tri-Lingual Artillery Dictionary. Vol. I. English—French—Italian. By E. S. Hodgson. London (Griffin) 1918.

Lectures on Tactics for Officers of the Regular Army, the Territorial Army, and the Militia. By Lt.-Col. F. H. Dyke. Aylsham, Norfolk (Barnwell) 1922.

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REGIMENTAL LIST. The following Postings have occurred during the period 16th December, 1921, to 15th January, 1922.

Postings.—R.H. and R.F.A.

Asser, Lt.-Col. V., C.M.G., D.S.O., from 31st Bde., to IV. Res. Bde. 4/1/22.
Atchison, Lt.-Col. H. W., from 11th Batty., to 31st Bde. 4/1/22.
Bartlett, Lieut. G. McL., from 7th Bde., to "L" Batty. R.H.A. 14/12/21.
Batchelor, Lieut. A. E. F., from Remount Depôt, India, to 121st Batty. 30/12/21.
Batchelor, Major V. A., D.S.O., from Half-pay List, to 31st Batty. 1/12/21.
Buckley, Capt. E. S., from Staff, to 35th Batty. 27/10/21.
Bush, Lieut. R. F. L., from 19th B.A.C., to 131st Batty. 4/1/22
Cherry, Major R. G., M.C., from Att. 4th Bde., to Adjt., 4th Bde. 13/1/22.
Chown, Lieut M., from 17th Bde., to I. Res. Bde. 21/12/21.
Clutterbuck, Major L. St. J. R., O.B.E., from R.A. Depôt, India, to 67th Batty. 15/1/22.
Constable, Lieut. W. B., M.C., from 131st Batty., to 19th B.A.C. 4/1/22.
D'Arcy, Capt. J. C., M.C., from Staff, to 131st Batty. 4/1/22.
Duke, Lieut. M., from 121st Batty., to 119th Batty. 30/12/21.
Durie, Major T. E., D.S.O., M.C., from Unposted, to Att. Arty. School, Larkhill 23/12/21.
Evans, Lieut. A. D., from I. Res. Bde., to 60th Batty. 22/12/21.
Harbord, Lieut. A. M., from Staff, to 27th Batty. 28/12/21.
Harris, Lieut. C. C., from Att. 1st Bde. R.H.A., to Att. 3rd Bde. R.H.A. 24/12/21
Hewson, Capt. A. G., M.C., from V. Res., to "A" Batty. R.H.A. 11/1/22.
Jephson, Lieut. E. W. F., M.C., from Att. "N" Batty. R.H.A., to Unposted. 6/1/22.
Kennerson, Lieut. A., from I. Res. Bde., to 57th Batty. 22/12/21.
Kirkman, Lieut. S. C., from 1st Bde. R.H.A., to "D" Batty. R.H.A. 13/12/21.
Knyvett, Major C. L., D.S.O., M.C., from Adjt. T.A., to 39th Batty. 4/1/22.
Lee, Capt. D. H., M.C., from 131st Batty., to 19th B.A.C. 4/1/22.
Mitchell, Lieut. G., from G.H.Q. Ireland, to 36th Bde. 14/12/21.
Packman, Lieut. S. A., from Att. R.E., to 9th Bde. 21/12/21.
Peter, 2nd Lt. G. A. C., M.C., from 88th Batty., to II. Res. Bde. 30/12/21.
Pridham, Lieut. J. E., from Att. Irish Comd., to Att. R.H.A. Depôt. 6/1/22.
Rowe-Evans, Lieut. C. B., from 97th Batty., to 19th B.A.C. 4/1/22.
Staveley, Capt. R., from "A" Batty. R.H.A., to 38th Batty. 6/1/22.
Stephens, Lieut. F., from I. Res. Bde., to 25th Batty. 22/12/21.
Taylor, Lieut. R. W., from W.A.F.F., to 28th Batty. 21/12/21.
Thorneycroft, Major G. E. M., D.S.O., from I.A.C.C., to Unposted. 9/12/21.
Treeby, Lieut. F. W., from G.H.Q. Ireland, to I. Res. Bde. 9/12/21.
Walshe, Major E. U., from 40 Batty., to R.A. Training Centre, India. 15/1/22.
Wark, Maj. (Rid.-Mr.) R. G., from R.F.A. India, to Att. 20th P.A. Bde., R.G.A. 30/12/21.
Weston, Lieut. M. T. D., from Att. R.E., to 9th Bde. 21/12/21.
Weston, Lieut. M. T. D., from 9th Bde., to Att. 8th Bde. 12/1/22.
Wilkins, Lieut. J. S., M.C., from 13th Bde., to II. Res. Bde. 30/12/21.
Williamson, Lieut. J. R., from 37th Batty., to 121st Batty. 30/12/21.

Postings.—R.G.A.

Aggett, Major (D.O.) W. E., from Arty. Coll., to Malta. 13/1/22.
Arnold, Capt. A., from Thames and Medway, to Personnel, Arty. Coll. 10/1/22.
Bignell, Capt. R. G., from Staff, to No. 2 Depôt. 17/12/21.
Brittan, Capt. C. H., M.C., from 15th Batty., to 79th Coy. 14/1/22.
Candy, Lieut. A. H. J., M.M., from 62nd Coy., to 3 Depôt. 11/1/22.
Coe, Major J., from G.H.Q. Ireland, to 14th Batty. 12/12/21.
Connell, Lieut. E. S., M.C., from 1st P.A. Batty., to 2nd P.A. Batty. 1/1/22.
Crockett, Lieut. E. K., from South Africa, to "J" Coast Batty. 11/1/22.
Davies, Capt. O. H., M.C., from Survey Coy., to Plymouth C.D. 13/1/22.
Edge, Lieut. R. St. G., from 108th P.A. Batty., to H.Q., 23rd Indian P.A. Bde. 1/1/22.
Edmeades, Major W. A., D.S.O., from 7th Coy., to 8th Coy. 14/1/22.

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Postings R.G.A.—Continued.

Evans, Major C. L., from "B" Coast Batty., to H.Q., Gibraltar C.D. 3/1/22.
Fasken, Capt. D. E., from Att. Irish Comd., to Att. Survey Coy. 3/1/22.
Hallifax, Capt. F. P., from Staff, to 31st Batty. 29/12/21.
Old, Lieut. (D.O.) J., from Portsmouth to Gibraltar. 28/12/21.
Pocock, Lieut. F., M.C., from South Africa, to "D" Coast Batty. 11/1/22.
Romanis, Capt. D. G., from Att. Irish Comd., to Tees and Tynemouth. 10/1/22.
Rooke, Lieut. S. T., from Staff, to Unposted. 14/1/22.
Spong, Capt. C. A. T., D.S.O., from 4th Bde., to "L" Coast Batty. 21/12/21.
Villiers, Capt. G., M.C., from Staff, to Khartoum Det. 21/12/21.
Walsh, Lieut. A., D.C.M., from Jersey, to Hong Kong. 3/1/22.

Cancellations.

Dean, Major A. C. H., D.S.O., O.B.E., posting to 14th Batty. from Portsmouth, dated 29/11/21.
Knowles, Major G. L., R.G.A., posting to Sierra Leone, dated 6/12/21.

Staff Appointments.

Royal Artillery.

Walshe, Col. F. W. H., C.M.G., D.S.O., A.-D.-C., C.R.A. 56th (London) Division T.A. 6/12/21.

Royal Horse and Royal Field Artillery.

Baker, Capt. H. A., M.C., A.-D.-C. to G.O.C.-in-C., Trinidad. 31/12/21.
Benbow, Lieut. E. W., Seconded to King's African Rifles. 24/11/21.
Cooper, Lieut. C. H., seconded to King's African Rifles. 24/11/21.
Drew, Lieut. A., A.-D.-C., to G.O.C.-in-C., Egypt. 1/12/21.
Earnshaw, Lieut. P., Seconded to King's African Rifles. 30/12/21.
Gubbins, Capt. C. Mc. V., M.C., Brigade Major R.A., 5th Divn. (Temp.) 28/11/21.
Henshaw, Lieut. W. H., Seconded to King's African Rifles. 24/11/21.
Jarvis, Lieut. D. P., R.T.O., Kantara. 19/11/21.
MacIlwaine, Capt. A. H., D.S.O., M.C., Officer of Cadet Co., R.M.A. 1/11/21.
Mason-Macfarlane, Capt. F. N., M.C., G.S.O. 3, India. 27/11/21.
Massy, Major H. R. S., D.S.O., M.C., G.S.O. 2nd Grade, 5th Divn. (temp.) 28/11/21.
Mellett, Lieut. J. A., M.M., Censor Officer, Curragh. 30/8/21.
Murray-Hudson, Lieut. G. A., Seconded to King's African Rifles. 9/12/21.
Paul, Major (Bt. Lt.-Col.) W. R., C.B.E., Att. Offr. A.2. War Office. 1/10/21.
Rusher, Capt. A. E., M.C., Adjt., 66th (Sth. Mid.) Bde., R.F.A. (T.A.) 12/1/22.
Sarson, Major E. V., D.S.O., Asst. Director of Arty., A.H.Q., India. 6/12/21
Spendlove, Lieut. W. H., Staff Capt., Tipperary Bde. (temp.) 25/11/21.

Royal Garrison Artillery.

Broadhurst, Lieut. (D.O.) G. S., Seconded for Union Defence Force, South Africa. 11/11/21.
Butterworth, Capt. B. M. G., M.C., Adjt. A.A. School, Perham Down. 1/11/21.
Guilford, Lieut. T. M. N., Gold Coast Survey. 2/11/21.
Le Gassick, Lieut. F. N., M.C., Intell. Officer, Ireland. 30/4/21.
Parkes, Lieut. G., Att. Tank Corps. 20/12/21.
Rybot, Lieut. F. J. C., Seconded to R.A.F. 9/1/22.
Underhill, Capt. N., Spec. Appt., H.Q., London Dist. 6/12/21.
Woods, Lieut. J., Att. Tank Corps. 22/11/21.

1st Appointment Antedated.

Carson, Lieut. T., M.C., Appointment as 2nd Lt. R.F.A., antedated to 3/7/15.

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Promotions (Regimental).

Anthony, 2nd Lieut. H. H., to be Lieut. 17/12/21.
Ashworth, 2nd Lieut. E. C., to be Lieut. R.F.A. 18/12/21.
Atchison, Bt. Lt-Col. H. W., to be Lt.-Col. 25/12/21.
Bourke, 2nd Lieut. H. S .J., to be Lieut. 18/12/21.
Breach, 2nd Lieut. C., to be Lieut. R.F.A. 17/12/21.
Bruford, 2nd Lt. F. L., to be Lieut. 18/12/21.
Bull, 2nd Lieut. F. C., to be Lieut. R.F.A. 17/12/21.
Christopher, 2nd Lieut. J. R. C., to be Lieut. R.F.A. 18/12/21.
Cleeve, 2nd Lt. A. J. E., to be Lieut. 17/12/21.
Cochrane, 2nd Lieut. T. Fitz. G., to be Lieut. R.F.A. 19/11/21.
Colley, 2nd Lieut. A. S., to be Lieut. R.F.A. 17/12/21.
Collier, 2nd Lieut. R. D. T., to be Lieut. R.G.A. 13/7/21, with seniority 27/4/21.
Davey, 2nd Lt. G. R. K., to be Lieut 17/12/21.
Feneley. 2nd Lieut. C. E., to be Lieut. 18/12/21.
Fennell, 2nd Lieut. G. W. P., to be Lieut. R.F.A. 17/12/21.
Fletcher, 2nd Lieut. R. G. T., to be Lieut. R.F.A. 18/12/21.
Griffith, 2nd Lieut. E. H., to be Lieut. R.F.A. 18/12/21.
Jones, 2nd Lieut. C. I. V., to be Lieut. R.F.A. 18/12/21.
Kindersley, 2nd Lieut. H., to be Lieut. R.F.A. 18/12/21.
Leveson-Gower, 2nd Lieut. H. N., to be Lieut. R.F.A. 18/12/21.
Lyall, 2nd Lieut. J., to be Lieut. R.F.A. 18/12/21.
Moffat, 2nd Lieut. C. D. A., to be Lieut. 17/12/21.
Musson, 2nd Lieut. A. H., to be Lieut. R.F.A. 18/12/21.
Olver, 2nd Lieut. G. C., to be Lieut. R.F.A. 18/12/21.
Ray, 2nd Lieut. R. G., to be Lieut. R.F.A. 18/12/21.
Sloan, 2nd Lieut. J. N., to be Lieut. R.F.A. 18/12/21.
Smith, 2nd Lt. I. K., to be Lieut., and to retain appointment. 18/12/21.
Stock, 2nd Lieut. S. M., to be Lieut. R.G.A., 13/7/21, with seniority 7/8/19.
Tozer, 2nd Lieut. L. A. E., to be Lieut. R.F.A., and to remain seconded. 18/12/21.
Uniacke, 2nd Lieut. H. C., to be Lieut. R.F.A. 17/12/21.
Ward, 2nd Lieut. A. A., to be Lieut. R.F.A. 18/12/21.
Waters, 2nd Lieut. J. R., to be Lieut. 18/12/21.
Wright, 2nd Lieut. L., to be Lieut. R.F.A. 17/12/21.
Yates, 2nd Lieut. M., to be Lieut. R.F.A. 18/12/21.

Promotions. (Non-Regimental).

Parrington, Major J. W., Temp. Lt.-Col. while holding his present appointment. 29/9/20.

To Temporary Half-Pay.

Cope, Lieut. H., R.G.A. 4/1/22.
Golding, Lieut. T. B., R.G.A. 7/1/22.
Montague, Major S. F., R.G.A., on account of ill health on ceasing to be employed. 1/1/22.
Newman, Col. C. R., C.M.G., D.S.O., on relinquishing Appointment. and tempy. rank. 10/12/21.
Newman, Lieut. S., R.F.A. 10/1/22.
Phillips, Lieut. S. N. H., M.C., R.F.A., on account of ill health. 12/1/22.
Thackeray, Lt.-Col. C. B., D.S.O., R.F.A., on ceasing to be employed. 1/1/22.
Weber, Col. W. H. F., C.M.G., D.S.O., on ceasing to be employed. 1/1/22.

To Half Pay List.

Forsyth, Lt.-Col. J. A. C., C.M.G., D.S.O., on completing 4 years Lt.-Col. 25/12/21.

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From Half-Pay.

Batchelor, Major V. A., D.S.O., R.F.A., 1/12/21, with precedence next below Major G. E. M. Thornycroft, D.S.O.

Transfers.

Allen, Major (Bt. Lt.-Col.) A. H., R.G.A., removed from the Regiment on permanent transfer to the R.A.O.C. 5/10/21.
Montanaro, Major C. A. H., R.F.A., removed from the Regiment on permanent transfer to the R.A.O.C. 10/9/21.

Retirements on Retired Pay.

Beardsley, Lieut. W. T. 30/12/21.
Bishop, Lt.-Col. C. F., R.G.A., from Half-pay List. 3/1/22.
Bridges, Major A. H., on account of ill health. 23/12/21.
Cameron, Major A. H., on account of ill health. 22/12/21.
Cant, Lieut. H., on account of ill health. 19/12/21.
Conner, Major D. G., O.B.E., R.F.A., with rank of Lt.-Col. 7/1/22.
Lamb, Major B. 23/12/21.
Laurie, Lt.-Col. K. C., R.F.A. 7/1/22.
Perrott, Major H. S., R.G.A., from Tempy. Half-pay List, on account of ill health. 2/1/22.
Phillips, Lieut. H. A., with rank of Capt. 21/12/21.
Roberts, Lt.-Col. H. B., O.B.E., R.F.A., from Temp. Half-pay List, on account of ill health. 6/1/22.
Salvin, Major H. C. J., R.G.A. 3/1/22.

Retirements with a Gratuity.

Anderson, Lieut. R. C., R.F.A. 7/1/22.
Galpin, Lieut. T. H., R.G.A., from Half-pay, with rank of Capt. 3/1/22.
Gillman, Lieut. J. F. 28/12/21.
Shaw, Capt. H. A., with rank of Major. 23/12/21.

Resignations.

Bradley, Lieut. J. L., R.G.A. 3/1/22.
Cox, Lieut. H. K., R.G.A. 10/1/22.
Dangar, Lieut. H. V. 23/12/21.
Hole, Lieut. R. H. 19/11/21.
White, Lieut. R. F. L., R.G.A. 12/1/22.

Deaths.

Brown, Lieut. G. L., M.C., Presumed to have been killed in Ireland. 1/11/20.
Rooke, Col. W. H. (retired) at Norwich. 29/11/21.
Tillotson, Lt.-Col. L., (retired), at Cadnam. 13/10/21.

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SIDELIGHTS ON WATERLOO.

BY LIEUT.-COLONEL C. HOLMES- WILSON, LATE R.F.A.

THE late Lord Wolseley in his book on the "Decline and Fall of Napoleon" sums up the Emperor's downfall in the dramatic words :—

"Since he miscalled the morning star
Nor man nor fiend hath fallen so far."

Since Lord Wolseley wrote the spirit of partisanship has disappeared. For a decade Waterloo formed the great theme for all military writers, till eventually contemporary critics began to contradict each other in regard to doubtful incidents. Now, in a more enlightened age, Napoleon is no longer regarded as an adventurer ready to sacrifice human lives in the pursuit of his political ambitions. In France his genius has been recognised by the celebration of the centenary of his death. During the Great War when the issue hung in the balance and the French were face to face with defeat, his lucky star inspired tired Generals to emulate his deeds and fight fresh battles on fields on which he had already fought.

The escape of Napoleon from Elba, his march to Paris and the stirring events that followed form an episode in themselves. His defeat at Waterloo tends to impress the uninitiated with the superiority of the strategy of the allied leaders. When, however, this is examined it can be proved that except for an adverse turn of the Wheel of Fortune victory should have lain with the French. The preliminary dispositions of the Allies courted defeat. Holding an area that had a front of 100 and a depth of at least 40 miles, Napoleon reckoned that it would take them two days to concentrate. As a result the Emperor decided to strike at the dividing line, as represented by the Charleroi—Quatre Bras—Brussels road.

The French Army, consisting of five corps, the Imperial Guard and four corps of cavalry, occupied widely dispersed cantonments including Lille, Valenciennes, Laon, Mezieres and Metz, with the Guard at Paris. The order for the concentration of these scattered units was issued on 8th June, and the march to the north then began. By the night of 14th the Imperial Army was assembled at Avesne, where the Emperor isued his historic proclamation to the assembled corps. Commencing with the words :—"Soldats, c'est aujourd'hui l'anniversaire de Marengo et de Friedland, qui deciderent du fois du destin de l'Europe," the order ended with an appeal to them "to conquer or to die." At the same time he wrote to his brother Joseph,

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informing him that on the following day (15th) he proposed to march to Charleroi "Where the Prussian Army is." In the meantime, the Allies had been informed of the approach of the French. Uncertainty was converted into certainty. On the night of 13th, Zieten who commanded the 1st Prussian Corps with outposts to the south of the Sambre, reported bivouac fires at Beaumont and Solre. As a result of this information, on the 14th Blucher ordered the IInd, IIIrd, and IVth corps to concentrate about Sombreffe. Wellington, however, decided not to alter his dispositions, though his Headquarters at Brussels were 34 miles from Charleroi, and he had no troops within supporting distance of Blucher.

This decision which has given rise to much comment undoubtedly jeopardised the success of the campaign, and many well-informed critics are of opinion that he should have altered his dispositions on the 13th, when it was ascertained that the French were massing near Maubeuge. The situation can however be appreciated best by the fact that on the afternoon of the 15th, 40,000 French had crossed the Sambre and 70,000 more had entered Charleroi. At the time the only Allied forces within reach were Zieten's Corps, 32,000 strong, and a weak force under the Duke of Saxe-Weimar at Frasnes, 3 miles south of Quatre Bras. Napoleon had he known these details might consequently have congratulated himself on the success of his first move.

Late in the afternoon of the 15th the Duke however at last took alarm, though he still refused to believe that the movement on Charleroi was the main attack. In spite of this he directed 25,000 men to march on Nivelles seven miles to the west of Quatre Bras, on the Namur road. Coinciding with the issue of these orders the 2nd French Corps, followed by the 1st, was advancing on the Charleroi Brussels road towards Quatre Bras. These corps combined numbered about 40,000 men, and by 7 p.m. the advanced guard of the 2nd Corps had driven the weak force under the Duke of Weimar out of Frasnes. Fate had also favoured the French on their right flank. It has been pointed out that on the 14th Blucher ordered the IInd, IIIrd and IVth Corps to concentrate on Sombreffe. The IInd and IIIrd Corps carried out these instructions and reached their rendezvous at 10 a.m. and 11 a.m. respectively on the 16th, the IVth (Bulow) however, did not march till the 16th. Blucher was consequently deprived of the services of 31,000 men, and on the 16th had to rely on three corps, about 87,000 strong.

The evening of the 15th and the morning of the 16th were consequently critical moments for both sides, and much has been written in regard to what ought to have been done and what was not done during this period. Such well-informed critics as Jomini, Clausewitz, Charras and Gourgaud disagree and in suggesting alternatives frequently put forward schemes inferior to those prepared by Napoleon. It is however apparent from what has been said that the plan of campaign had been well thought out, and that the Emperor's preparations were considerably in advance of those of the Allies. A great

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advantage had been gained on the 15th, but it is obvious that if the most was to be made of this, no time should have been lost in following it up. It is in this phase, however, that the cycle of contradictory orders and delays began.

In studying a campaign it is impossible to adopt the methodical method and ignore the human element. In the Great War mechanism relieved the individual soldier of many of his former burdens, though he was subjected to greater mental and physical strains. In 1815 the physical factor played a noticable part, and was forcibly brought forward on the 15th June. The French Army had struck camp at 3 a.m., and marched till 7 p.m., the high water mark of its advance reaching a line that ran approximately through Frasnes and Fleurus. In spite of this great physical effort many critics are of opinion that the movement should have been continued to the Namur—Nivelles road, with a view to seizing Quatre Bras and Sombreffe. Apart from the question of the fitness of the troops for further operations the criticism is interesting, as it was answered by Napoleon from St. Helena as follows: "The Emperor's intention was that his advance guard should occupy Fleurus, keeping his troops concealed behind the wood near this city; he took good care not to let his army be seen and above all not to occupy Sombreffe. This would of itself have caused the failure of all his manœuvres, for then Marshal Blucher would have been obliged to make Wavre the place for the concentration of his Army, the battle of Ligny would not have taken place . . . . . " From this it is clear that the Emperor wished to destroy the Prussian Army before it was fully concentrated, and that he did not wish to alarm Blucher by occupying Sombreffe. The same line of reasoning cannot be applied to Quatre Bras, though it is difficult to see what useful purpose would have been achieved by its occupation on the night of the 15th. The French at Frasnes were only three miles from the cross roads, whereas the Allied force at Nivelles had seven miles to march. Under these circumstances Ney gave his tired troops their well-earned rest.

Had the Allies been asked to make forced marches to meet Napoleon's sudden attack, they would have shared the hardships endured by the French. The flaw in their plan of campaign lay in the distribution of their forces and the selection of Quatre Bras and Sombreffe as points of concentration, as only portions of their armies could reach these places in time to oppose a sudden advance. This, as already pointed out, may be proved by the fact that when Wellington was writing his orders on the 15th for the movement of three divisions to Nivelles, Ney with the 2nd Corps was attacking Frasnes. The Duke's indecision continued till 10 p.m. on the 15th, when he heard of the Prussian concentration at Sombreffe, he then issued orders for a general movement towards the left. At midnight, however, he heard from Mons that the French had turned towards Charleroi, he is then supposed to have issued orders for a concentration on Quatre Bras, though the existence of these has never been proved. In fact the only orders isued on the 16th now extant direct the second division and the

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cavalry on Braine-le-Comte and the 1st Dutch Belgian division on Enghien. No mention is made of Quatre Bras. Orders for the concentration must however have been issued during the early morning of the 16th, as a "disposition" showing the distribution of the troops was prepared by the Chief of the Staff, and in this Quatre Bras is given as the rendez-vous for all units within marching distance. This "disposition," apart from affording a clue in regard to the nature of the orders issued, deserves consideration on account of its inaccuracies. Wellington believing it to be correct wrote to Blucher from Quatre Bras at 10.30 a.m. on the 16th, and promised him help. This promise could not be carried out, as the troops were not in the positions shown in what may be called the "field state." In fact the discrepancies were considerable. To take two instances. The 1st division which was shown at Braine le Comte at 7 a.m. (16th) did not reach that place till 9 a.m., and then halted waiting orders till noon: when the G.O.C. continued the advance on his own responsibility. This may seem bad, but the fate of the 2nd division was worse. It was also shown as having reached Braine le Comte at 7 a.m. (16th), whereas in reality the order to march was not received at Ath till 10 a.m. (16th), and the divisions did not reach Braine le Comte till midnight. These examples prove that putting aside the question of supporting the Prussians, the Duke ran considerable risk of being defeated himself at Quatre Bras by the 1st and 2nd Corps under Ney. This may be emphasised by the fact that on the morning of the 16th Quatre Bras was held by a Dutch Belgian division of Perponcher's corps; which had occupied the position by order of the Corps Commander. This division was the only force that lay between Ney and his objective on the morning of the 16th.

Napoleon on the eve of Jena, when he received definite information in regard to the enemy's movements, summed up the situation in the trite sentence "Enfin le voile est dechiré." History however did not repeat itself at Frasnes on the 15th and 16th June; if it had Ney would have undoubtedly attacked the Dutch Belgian division holding Quatre Bras before it was reinforced. Unfounded speculation cannot, however, be permitted when the safety of an army is held at stake, so that Ney was possibly justified in holding his hand, though the prize, had he known it, was within his reach. The balance held between caution and boldness may, however, easily become unhinged. Ney has been described as "the boldest of the bold", yet we find him contrary to his character hesitating on the 16th. He appears for some unexplained reason to have mistrusted Napoleon's instructions. He is reported to have received verbal orders to seize Quatre Bras on the evening of the 15th, when it was only held by one Dutch Belgian brigade. Delay, however, followed delay. On the night of the 15th—16th, the Marshal rode to Charleroi to see the Emperor, returning to Gosselies about 2 a.m., where he remained till 7 a.m. He then had two infantry divisions, and a cavalry corps within striking distance of Quatre Bras, which at the moment was held by one Dutch Belgian division, one brigade of which had already been roughly handled! The

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French had probably never been nearer victory and yet so far from it, as when Ney hesitated south of Frasnes. Every moment's delay gave the Allies time to concentrate whereas an immediate attack would have found them completely unprepared. Ney however waited. At 10 a.m. he received a letter from the Emperor followed by definite orders, directing him to occupy Quatre Bras with the 2nd and 1st Corps and Kellerman's Cavalry Corps. But, in spite of these instructions, further delays occurred, with the result that the attack did not begin till 2 p.m. Even at the eleventh hour he almost snatched success from the vortex into which he had allowed it to drift. Perponcher's Dutch Belgian division still held Quatre Bras. Against this Ney's two divisions made easy headway, till their advance was checked by the arrival of Allied reinforcements, comprising Picton's division and the Duke of Brunswick's Corps, followed later by Alten's division. Ney then found himself outnumbered. The corollary may seem obvious. A great opportunity had been thrown away, an opportunity which if made the most of might possibly have altered the course of the campaign. Napoleon had explained to Ney that when he had beaten Blucher at Ligny he proposed to make Quatre Bras his base for his advance on Brussels. When, however, he had won the battle of Ligny he found that Ney had been beaten at Quatre Bras!

The wish is sometimes considered father to the thought, with the result that those who consider that Wellington should have been beaten at Quatre Bras are frequently accused of partisanship. A brief consideration of the course of events will, however, disprove this. It has been seen that Ney received a formal order from Marshal Soult, the Chief of the Staff, on the morning of the 16th. This order directed him to "unite the corps of the Counts Reille (2nd) and d'Erlon (1st) and that of the Count of Valmy (3rd Cavalry), who has this instant started to join you; with them you ought to be able to beat and destroy any force of the enemy which you may meet." The force referred to had a strength of about 47,000 men, whereas Wellington's detachment did not muster more than 31,000. Under these conditions it is evident that Ney would have had a considerable superiority in numbers had he been in a position to employ all the troops placed at his disposal. He was, however, unfortunate, and cannot be considered wholly to blame, though his failure to use his cavalry has never been fully explained. The 1st Corps (d'Erlon) had been delayed, and when its leading division under Durutte reached Frasnes shortly after 4 p.m. it was directed by one of the Emperor's staff officers, who was carrying a message to Ney, to march on Brye. Durette consequently turned to his right, and was followed by the remainder of the Corps. When Ney heard what had happened he ordered d'Erlon to return, with the result that the 1st Corps marched back, reaching Frasnes about 9 p.m. It is consequently apparent that the services of 20,000 men had been wasted during the day. The loss entailed by this marching and countermarching may be judged from the fact that the head of the column had reached Frasnes about 4 p.m. Frasnes was only 2½ miles from Quatre

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Bras. Consequently, had Durutte's division and the divisions following it been pushed forward they would have reached the scene of action before Wellington's reinforcements had turned the scale in favour of the Allies.

Quatre Bras cannot be considered without Ligny, and in considering Ligny it should be noticed that Napoleon has been severely criticised for not attacking the Prussian position on the morning of the 16th. Many reasons have been given for the supposed delay, one being that the Emperor was suffering from some mysterious malady that prevented him from issuing instructions or exercising any control. That this was not the case may be proved by the fact that he issued orders throughout the morning of the 16th, commencing at 5 a.m. with one to Ney. In addition, when he had completed his preliminary orders for the battle of Ligny he rode to Fleurus, and proceeded to carry out a reconnaissance of the Prussian position on foot. Consequently the reason for the delay must be attributed to some other cause. Several theories have been put forward, but the most likely solution seems to be that the troops were exhausted by their efforts on the 15th, with the result that the columns had not closed up. This applies especially to Ney's command, portion of which was still to the south of the Sambre on the night of the 15th—16th. The Emperor was aware that the Anglo-Belgians were likely to concentrate at Quatre Bras, he consequently showed a natural disinclination to attack Ligny till he felt assured that Ney could hold Wellington in check. That this fear was genuine is clear from the number of enquiries sent to Ney on the morning of the 16th, in regard to the position of the 1st Corps. The delay involved may consequently be largely attributed to Napoleon's anxiety for the safety of the left flank of his right wing or main army. This loss of time was further accentuated through the fact that the Prussian position at Ligny was not attacked till 2.30 p.m., with the result that the engagement continued till after 9 p.m. Darkness had then set in and put an end to the pursuit. Owing to this, touch was lost with the Prussians, and the way paved for the final drama on the 18th.

The interest of the Waterloo Campaign has generally hinged on the result of the battle that gives it its name. This is however in many respects the least interesting of the events that led up to the final defeat of the French. The 15th and 16th were the dicisive days of the campaign—Waterloo was the aftermath in which the result had become a foregone conclusion. Stress has consequently been laid on the failure of the left wing, as many of the advantages gained through the rapid and unexpected concentration of the 15th were lost by the delays of the 16th. Wellington, for instance, was given time in which to collect portion of his scattered Army. Had Ney been in a position to attack this detachment with his two corps, there can be no doubt that the Duke would have been forced to retreat, and it is possible that the retreat might have become a rout, as the heads of the columns concentrating on Quatre Bras would have been cut off by the French. There would then have been no Waterloo.

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War is in many respects a matter of contradictions, thus on the 16th and 17th, Napoleon, the greatest leader of the age, was found at his worst when his admirers would like to have seen him at his best. There is no need to moralise over his fall, human nature has its limit of endurance, and the Emporor reached his on the night of the 16th. The spirit was willing, but as the spirit overstepped the limitations of the body, the brain refused to act. Consequently, as the Army looked to Napoleon and no staff officer could take his place, matters were brought to a dead-lock on the morning of the 17th, when the road to Brussels was barred by 45,000 men under Wellington at Quatre Bras. At the moment the French had a preponderating force ready to strike a decisive blow. Ney had the 1st and 2nd Infantry Corps and Kellerman's Cavalry Corps with Desnouette's cavalry division in position at Frasnes, and the Emperor had the 6th Corps, the Guard and Milhaud's Cuirassiers under his own control at Brye. Had these combined forces moved on Quatre Bras early on the 17th, the Anglo-Belgian force holding it would probably have been destroyed. Lethargy, however, seems to have seized the French Staff and held it fast till the moment for action had passed. Ney did not inform Napoleon of his defeat at Quatre Bras and Soult, as Chief of the Staff, forgot to tell Ney the result of the action at Ligny. The morning was consequently spent in picking up information, and Napoleon made no move till 10 a.m., when he ordered the 6th Corps, the Guard and Milhaud's Cuirassiers to Marbais, a point four miles east of Quatre Bras on the Nivelles—Namur road. At noon Ney was ordered to attack Quatre Bras and informed that the Marbais column, under the command of the Emperor was moving to his support. It is clear from this that the advance had been planned at least four hours too late. When Napoleon reached Quatre Bras and found that Wellington had retired, he realised the magnitude of the opportunity he had missed and told d'Erlon in bitter tones that "They (the Staff) have ruined France." The pursuit was then vigorously taken up and continued till it was stopped by torrential rain. The French had consequently lost three opportunities of bringing the campaign to a decisive close, and were now face to face with the possibility of a junction between Wellington and Blucher at Waterloo.

As the situation at Quatre Bras on the morning of the 17th has not been fully understood, its dramatic possibilities have been ignored. The pursuit of the Prussians on the other hand has attracted general attention, this however, appears to be superfluous. The French had already lost their opportunity, so that Grouchy's march plays a minor part in the plan of campaign. Fate had been unkind to Napoleon. The 3rd and 4th Corps had been allotted to Marshal Grouchy's command. As these corps had borne the brunt of the battle on the 16th, they were not in a position to take up the pursuit till 2 p.m. on the 17th. The Prussians had then 18 hours start and there was little prospect of Grouchy intercepting them. Napoleon has been blamed for this delay, but it is obvious that he had to choose between two evils. Had he used his fresh troops, the 1st and 6th Corps or the

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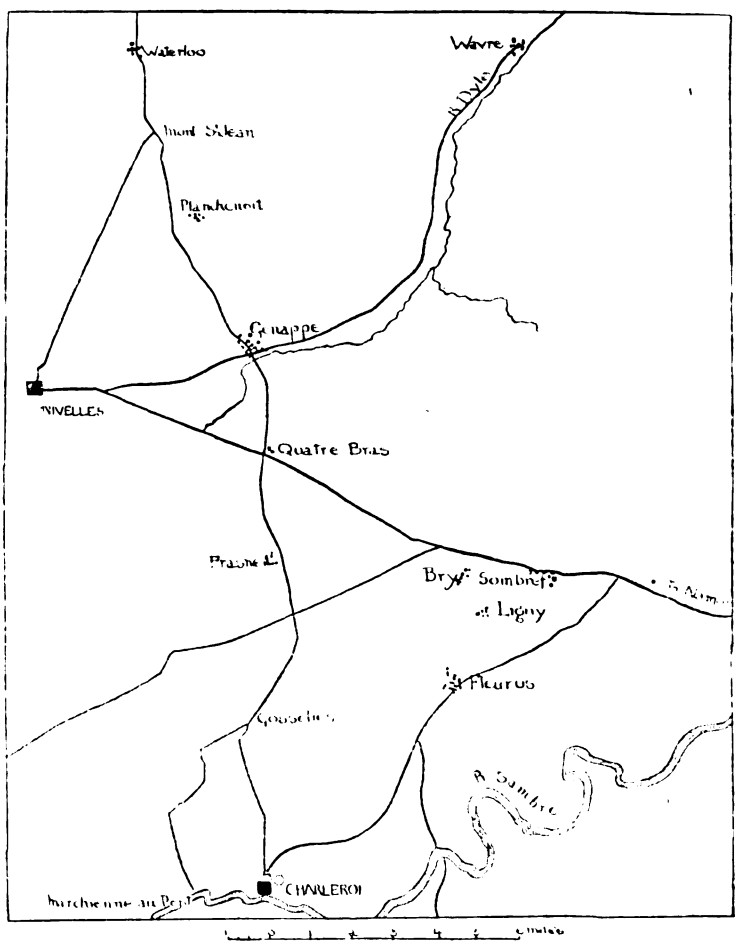
Guard, he could not have followed Wellington to Waterloo. In addition, at the time he made his decision he was under the impression that Blucher had retreated on Namur. As, however, it is held that the French had exhausted their vitality on the 15th and the 16th, it is obvious—following the same line of argument—that the moment for strategical combinations had passed. Under these conditions, Grouchy's movements may be ignored. The curtain, so far as French strategy is concerned, had been rung down at dawn on the 17th, when it rose again the Emperor was an exile in St. Helena.



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EVOLUTION IN OFFENSIVE METHODS.

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PART I.

Evolution in Offensive Methods.

THE operations of the last war examined as a whole might be classified into two relatively short periods on the western front of open warfare divided by a much longer period of static warfare. Distinct as they appear at first sight it must not be thought that in each one of them the aspect of the struggle remained constant; on the contrary there was frequent change in the doctrine and technique, the objectives of attack and their method of execution, the tactics of attack as well as the armament of the troops. All these factors have never ceased to develop, gravitating around the old principles of war, which do not change, and the reason? Simply that the war took place at a time that was particularly fruitful from a scientific and industrial point of view. One may say that each month and almost each day brought some new invention into being in the realm of chemistry and physics.

But the newly discovered weapons only kept their value for a limited period, that which the enemy needed to find the antidote and construct the necessary means of defence. For which with rapid modern industrial development a few months sufficed.

This partly accounts for the rapidity with which the minor tactics changed.

It is in this way that we saw the revival of all the weapons of antiquity (even including the catapult and arbalest) whilst at the same time Artillery continually extended the limits, the variety of its calibre, its range and the power of its guns. We have revived the grenades, flames and liquid fire of the Middle Ages, and at the same time we have made use for gas shells of all the latest inventions in chemistry. We have developed to the utmost the defensive organisation of the ground, adapting concrete and all the developments of permanent fortifications to Field Work and at the same time we have reintroduced all the details of ancient siege warfare.

And finally we ended the war, as we began it, that is to say without a strand of wire entanglements, without a trench, and almost entirely with the aid of our 75-mm. gun.

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The object of this Lecture is in fact to explain in a general way the evolution of our methods of warfare and more especially of our offensive tactics, during this war; to point out particularly how in the French Army as well as the German Army, this evolution was directed more and more towards "The effort to obtain surprise", and finally to show how during the course of this rapid evolution, the ever changing problems confronting the Artillery were dealt with in the never ceasing struggle between gun and armour.

The problem of the break through. The last war brought to grips, not only armies of limited strength but nations in arms, who threw into the struggle their whole resources in men and material; this great accumulation of resources thrown into action resulted in an ever increasing extension of the battle front beyond previous experience. Each adversary sought the necessary space for manœuvre with a view to outflanking the wing of the other and their fronts were extended from the sea to Switzerland and where two insurmountable obstacles were found for flanks to rest on.

On the other hand fire power, which from the beginning was a revelation to all, soon assumed gigantic proportions, as much in the perfections effected in weapons in use as in the new weapons continually appearing. In the face of this *powerful force*, to which the only immediate and possible *resistance* was "fortification", Troops went to ground, and it was thus that after the first few months of the campaign, open warfare gave place upon our front to a true war of siege and position. The "Front" was born and static warfare commenced, a war of engineers rather than soldiers, a murderous inchoate period of stagnation when the problem of the "Break through" tended to dominate all others.

During these three years, it was in vain that the two adversaries sought by repeated offensives to effect the "evenement" in the Napoleonic sense, that is to say the demoralising blow, which would threaten the enemy lines of communication and force him by threat alone to retreat or be defeated.

As there were no more wings and no more flanks, it was sought to create them by frontal attacks.

This then was the aim of all offensive actions during three years; break through the enemy front, break through sufficiently rapidly and effect a sufficient gap, that the enemy should be unable to mend his line in the time needed to imperil his communications.

Up to 1918 both sides had failed, and the old axiom of Napoleon, "The Breach once made, the equilibrium of forces once broken, all else becomes useless" was at fault. Why?

1. Because where the break through was effected it was *too narrow*, it could not be enlarged step by step as in open warfare, either because the means were lacking when the work was to be done, or perhaps more because on account of the close intersection of defensive works and the power of resistance, their defensive organizations permitted the enemy quickly to limit the effects of a local reverse.

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2. Or because before the complete break through on the 1st line of positions, the enemy withdrew and was able to retire upon other prepared positions to the rear, which permitted him to shorten his front and to put up again an effective resistance. And then all had to be begun again; for each new position fresh and methodical preparations were necessary for regaining touch, for re-establishing the state of siege on the old principles, and with the same delays.

A close study of the principles on which our great offensives were based, and the main instructions which showed their various stages will carry conviction that our Higher Command were not blind to these considerations.

The experience of the 1st winter (1914-1915). During the first winter of the period of stabilisation we undertook petty local actions as much for maintaining the offensive spirit of the troops as to wear down the enemy. On account of the mediocrity of our resources in artillery and the inadequacy of our munition supply, these actions were usually confined to very small frontages (often only of battalions) and of which the result was often the bare capture of a few observation posts.

Nevertheless one of them carried out in Champagne between 15th February and 8th March 1915, assumed the importance of a veritable battle, as much from the size of the forces engaged, as by the duration of its development. Although eventually it attained appreciably material results (ground gained, prisoners, enemy losses) it had no influence upon the general trend of the operations. There was no doubt about it. The fact was approved and had to be admitted. Infantry was entirely powerless before barbed wire obstacles covered by machine gun fire, and to hurl it against positions intact was a useless sacrifice.

It is true that preliminary attempts had been made previously to disorganize these positions, by preceding these attacks by an Artillery bombardment, which however, was reduced to a very short duration, partly for the sake of economy in munitions, and partly to produce surprise effect. But the assailants themselves had been the first to realize the inadequacy of this shortened artillery preparation.

Hence it was impossible to go on fighting thus with men against material, and to waste our strength in local engagements which though indeed glorious, were too small to bring about a decision.

What was necessary was to force the enemy to retire beyond our frontiers, and to that end to break his front, and through the gap thus produced to pass sufficient troops able to so manœuvre as to take his defensive lines in reverse whilst the cavalry pushed on over unfortified country up to the great railways which fed his armies. To arrive at this result our higher command concluded that[1] it was necessary first of all to plan operations more methodically and more in accordance

[1] Extract from Notes issued by G.H.Q. in February and April, 1916, notably Memorandum of the 10th April on the protection of attacks.

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with the conditions of the new forms of war, and to this end not to attack except after carefully organised preparations, to abandon isolated attacks which were more costly and less productive than a concerted attack. Secondly, to attack on as broad a front as possible. To endeavour to utilise the factor of surprise by mounting operations with suddenness and speed; to precede these attacks by long and detailed artillery preparation designed for the destruction of the elements of the enemy defences. Finally, to endeavour to exploit successes by the pushing in of reserves held in readiness. These were the principles on which the Memorandum of the 19th April, 1915, on "the object and the conditions of a concerted offensive action," was based, a Memorandum which in truth constituted the first complete document laying down the whole as well as the details of the conditions of the new method of attack—a method which was going to be inaugurated by the master-stroke of the 9th May, 1915, in Artois.

The year 1915. The battle of the 9th May in Artois.

The higher command had decided that an offensive of great extent was to be undertaken, in co-operation with the British Army, by the 10th Army in the direction of Lens. Chiefly with the object of pinning down large German forces on our front and thereby assisting the work of our Russian Allies on the Eastern Front.

The General who commanded the army corps entrusted with the principal task was in a word General Petain, who was one of the first to discern that misguided force would lead to nothing, and that under new conditions it was necessary to employ new means and new methods. Under his direction the operation was prepared for a period of three weeks with minute care :—

(1). The artillery preparation properly so-called, hitherto conducted without method and without accuracy, was controlled by a detailed programme. The destructive bombardments were supervised and observation of shoots scrupulously carried out. This lasted nearly six days.[1]

(2). The preparation of the battle area was an innovation : the assailing troops, square with their objectives, attacking from jumping-off trenches, pushed up to start with, to about 150 metres from the enemy, would only have to cover a minimum of open ground. Reserves and supports were kept sheltered in special assembly trenches. A vast network of communication trenches both "up" and "down" connected the assembly and the reserve trenches with dumps of munitions, rations and tools, and with aid-posts.

(3). The artillery had pushed its gun positions as far forward as possible ; its changes of position were pre-arranged and its communications with the infantry were made certain of.

(4). Finally, the forces employed were of some magnitude : 3 army corps and 350 heavy guns attacked on a front of 15 kilometres.

[1] The intention was four ; it was extended to six on account of the weather.

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On the 9th May there was a brilliant success: in a few hours our assaulting waves swept over the enemy positions on a frontage of 6 kilometres to a depth of three kilometres; the enemy front was pierced. But this almost unhoped for success outran our foresight, and could not be thoroughly exploited on account of a lack of reserves ready to hand at the critical moment. The enemy had time to stop the breach.

This operation led to the following conclusions:

(1). The piercing of the enemy line was possible.

(2). The operations must be organised and prepared in the greatest detail.

(3). If it succeeds the success occurs with such speed that it is necessary to have brought up beforehand in direct contact with the attacking army corps the force that is detailed to exploit the success.

(4). It must be carried out on a big front, so that the enemy will not be able to rake the attackers with the cross-fire of his artillery.

(5). A long and accurate artillery preparation is necessary to make certain of the destruction of enemy defences. A makeshift attack with a short preparation against a fortified area is doomed to certain failure.

(6). Finally, progress is more assured over open ground than in close or inhabited country; strong points formed of villages being particularly difficult to attack under the limited power of our artillery support at that time. From this time onwards we shall see a constant evolution taking place in our offensive methods. From this month of May 1915, in which the genius of a great foot-soldier, General Petain, crystallised for the first time the pattern of the "break-through" battle of which the successors were only variations, one may say that each of our great offensives has marked a stage of these developments, and from each of these our higher command has learnt fresh lessons and drawn new conclusions.

In this way from year to year there appeared those notable instructions of our G.H.Q. on the offensive, instructions which, were, however, only in force for a short time, since it sufficed for the introduction of a new weapon, a hitherto unknown method of tactics, either invented by us or our adversaries, for this entire edifice to crumble.

Champagne, September, 1915.

Use was made of these lessons, and for three months the experience gained was utilised in perfecting the detailed method. This time an operation of much greater extent than the preceding ones was involved. We did not only reckon on a tactical success, but the breaking of enemy lines on such a front that we would be able to push through into open country masses of cavalry followed by several army corps. The most favourable country appeared to be the plain of

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Champagne, a region where a rapid advance was unlikely to encounter many natural obstacles. But the difficulties were not less great on account of the multiplicity of defences built up by the enemy, owing to successive positions which it was proposed to carry by a single assault. Further, the second position, 5 or 6 kilometres in rear of the first, was particularly difficult to deal with since it was sited on a rear slope which was completely hidden from the view of our ground observers. General Petain, promoted to the command of an army, was to carry out the operation with 30 infantry divisions and 7 cavalry divisions, supported by 1,200 75-mm. guns and 850 heavy guns on a front of 25 km. from the Main de Messiges to the village of Auberive. This formidable operation was moreover co-ordinated with the Franco-British offensive in Artois, and to be supported in case of immediate success by the 5th French Army between Craonne and the Aisne.

Every condition which promised success had been utilised: the attacking infantry divisions had been rested and trained in a back area for several weeks; every measure had been taken to bring out the factor of surprise by the concealment of preparations, by the distribution of false news, and by abnormal activity on fronts other than those of the attack, etc. Instead of the few assaulting waves of the month of May, the attacking troops were disposed in depth to a very considerable extent; in each attacking sector the army corps of the first line was backed up by another in reserve, whilst the front army corps itself only put a division of infantry into the front line. Instead of close objectives, distant objectives had been assigned to the troops, to such an extent as to go beyond the entire system of German organisation for defence. In a word, the infantry was asked to go as far as possible. Briefly, great results were hoped for, and rightly so; three-quarters of the French forces were to be engaged with a support of 2,000 heavy guns and 3,000 75-mm. guns in this general offensive of September. The attack was launched in Champagne on the morning of the 25th September, but in spite of a complete initial success, in spite of the capture of considerable areas of ground and the taking of 15,000 prisoners and 100 guns, by that very evening the attempt to break through had failed, and the operation did not give the results hoped for because the execution itself was at fault:

(1). The prolonged assault that the troops were called upon to make was not everywhere carried out with calmness and method, and after an irregular advance of three or four kilometres, certain units were completely disorganised, comprising only a gang of men who had lost all tactical cohesion, and at the mercy of the smallest counter-attack.

(2). In consequence of the disorderly form taken by the attack, the close liaison between the artillery and the attacking troops was but very imperfect in spite of all the preparations taken to that end. And so this great lesson was evolved by General Petain, commanding the second army. One must henceforth make up one's mind to

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subordinate to the infantry during the attack, the action of the supporting artillery.

(3). In consequence of the lessons of Artois, the army reserves had been brought up into close contact with the assailing troops, whom they followed automatically. Hence they came under the same murderous bombardments, suffered heavy losses, and having no elbow-room, were incapable of manœuvre.

(4). Artillery preparation against the second position on account of the distance could only be carried out by the long range heavy guns; the observation of the shoots was difficult, and zone-fire carried out was inefficacious. Owing to the Germans having sited their trenches on a rear slope, the wire was uncut ,and it was in vain that our troops, having with difficulty arrived within a few hundred metres of the second position, made every effort to break through them. It was necessary really in order to carry through this task to have accurate fire; this entailed time for fresh methodical preparation, selection of observation posts, and organisation of communications, consequently a lull in the operations was necessary. Thus the enemy had profited from the lessons of our offensives of the month of May, and had found the antidote. In his report made in the month of November 1915, General Petain set out in these words the lesson of the occurrences and explained thus all the difficulties of the problem. "The battle of Champagne demonstrates the difficulty, if not the impossibility in the present state of armament, with the preparatory methods and the forces opposed to us, to carry with one rush successive enemy positions. The material strength of these positions rests above all in the obstacles provided. As long as these are not destroyed the best-laid infantry attacks even when most energetically carried out are doomed to failure. When an attack is going well, a few hours suffice to take the first positions, but once these positions have been taken one must carry on with taking the next. This attack cannot be carried out except after a long fresh preparation. The Germans will take advantage of the respite thus given to them to bring up troops and guns and to prepare a third position in rear against which the attack must be launched on the same principles, comprising the same stages, and encountering the same difficulties. These successive attacks will cause us a considerable waste of man-power, an unheard-of expenditure of ammunition, and neither this waste of man-power nor this expenditure of munitions seem to offer any hope of compelling the definite retreat of the enemy, unless it so happens that after the second blow of the battering ram there be no fresh troops to oppose us.

General Petain then drew this conclusion therefrom that the general plan of operations must necessarily comprise two successive phases:

(1). The wearing down of the enemy. (2). The decision.

(1). *The wearing down of the enemy* can only be arrived at by a general Allied Offensive, which should only aim at the capture of *objectives limited in depth, and without endeavouring to carry out a*

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break-through. Above all the point is to wear down the enemy by attacks with limited effectives and by bringing all known means of destruction to bear against him, to make him suffer such losses that it will subsequently be possible to force a decision. *Therefore the principal part will be played by the gun and by destructive weapons, and not by the infantry.* "The essential conditions of such a thrust are the possession by each army of the maximum amount of heavy artillery of every calibre and an almost unlimited supply of ammunition."

(2). *The decision.* When this attrition of the enemy is judged to have been sufficient, then and only then will one pass to the decisive phase, which will be carried out at several well chosen points and on fronts of at least 20 km., and in the form of successive assaults. It is, absolutely necessary to arrange for lulls between successive efforts, firstly, because the infantry that has made the first effort must be relieved, secondly, and, principally because the artillery after an advance must build up a minute organisation of its fire direction and carry out fresh preparatory work.

"*Two contradictory conditions will then present themselves.* On the one hand, the necessity of holding up the attack to carry on with fresh preparation, and on the other hand, the necessity to act with speed in order to give the enemy as little breathing space as possible."

Thus the axiom became firmly established : destroy entrenchments and obstacles by the gun. Do not send the infantry into the battle except after a long, careful and violent artillery preparation, which will have rendered the enemy position "ripe for the assault", as the Germans say; "*the artillery conquers and the infantry consolidates.*" that was the formula.

In this way the basic principles of the Memorandum of the 16th January 1916, *on the object and the conditions of a concerted offensive battle* were fixed, and that of the 16th January, 1916, *on higher formations in the offensive battle.*

To sum up, in 1915, the infantry had been required to go forward to the greatest extent possible. Henceforward this advance was to be regulated in accordance with the limits imposed by the artillery.

Year 1916—Verdun. The Somme.

The year 1916 is identified with the two great battles of Verdun and the Somme.

Verdun. At the time of their attack at Verdun, the German Great General Staff flattered themselves that they possessed the password for the victorious offensive; it was on material rather than on the gallantry of the troops that they depended for the force capable of overthrowing the barrier. After having accumulated masses of artillery and of munitions and of colossal guns, they replaced preparations lasting several days such as we had carried out during the preceding years, by a bombardment of but a few hours' duration, but of unexampled violence, and one which more by its moral and surprise effect

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than by its material destruction, was to destroy the capacity for resistance of our defence.

The initial success between the 21st and 24th February may have fulfilled their expectations, yet nevertheless, the German higher command showed itself incapable of exploiting a situation that the very impetus of its success had created unexpectedly.

It was in vain that it multiplied its further attacks carried out by masses of men, all its efforts remained fruitless, and after four months of titanic combat, if the result were reckoned by the gain of a depth of 12 km. of ground, it was at the cost of 500,000 men and they failed to take Verdun.

The Somme. During this time the French higher command had realised that it could not ease the German pressure on the Meuse except by launching a major offensive elsewhere, and so it staged in co-operation with the British Army, the great operation of the Somme; in this a break-through on a front of 40 km. was hoped for, and by overrunning the open country in the direction of Cambrai, to reach the great artery which fed all the northern German front.

It seemed that this operation presented itself to us under the most favourable auspices, for we had learnt a great deal during the uninterrupted struggle of four months before Verdun: *Artillery spotting by aircraft,* aeroplane photography, and observation had been perfected to a great extent, and now enable an exact and swift control to be maintained over bombardments.

Means of communication between artillery and infantry had been developed.

Our new equipments began to be delivered from the workshops, and our higher command had acquired the art of handling great masses of artillery.

Last but not least, the innovation of the creeping barrage enabled the infantry to be continuously and thoroughly protected during its advance. Moreover we had provided a better equipment for infantry in such formations as we had been able to withdraw from the Verdun battle.

To start with the number of machine-guns had been considerably augmented; in June, 1916, each battalion was provided with a company of 8 guns. At the same time the machine rifle, a weapon lighter than the machine-gun and more powerful than the rifle, had been taken into use, and this though normally supplied with only 200 rounds could fire up to 140 rounds a minute at critical moments.

It was at this period too that the 37-mm. gun with a useful range of 1,500 metres was first issued to the infantry, and it was designed to destroy machine-guns in action by direct fire.

In the matter of grenades which had been abundant at Verdun we had learnt in time to select from the numerous patterns the best for retention, and also after the middle of 1916 our troops were

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equipped with the *V.B .grenade*, which was fired by means of a discharger cup attached to the rifle and enabled useful barrage fire to be put up at 150 to 180 metres range. *It was thus a regular little artillery for the section or with the company.*

The battle which started on the 1st July by an application of the method of breaking-through by artillery on an even greater scale than formerly, justified at the start all our hopes by an advance which for the time was astounding. But there again we were deceived by events. *Developing the procedure of defence in depth* by which they had resisted our offensive of 1915, the Germans succeeded in preventing the breaking of their front, by their "*elastic defence*" which allowed the attacker to enter the ground, but which forced upon him enormous expenditure of ammunition and an endless succession of attacks. And in spite of almost continuous progress, after six months of efforts and of sacrifices, we had not succeeded in reaching Peronne, barely 10 km. from the jumping-off line.

The nature of and lessons drawn from these two battles. These two battles of Verdun and the Somme show themselves, as we shall see, to be very much of the same description. Attacks on fronts that were still too restricted, even with material means which had already become very powerful, directed against the same point or against points very close to each other, a *struggle of attrition both on the one side and the other characterised by certain success, it is true, but not a decisive one.* The trench barrier had in places been slightly pushed back, but only to become thicker and tougher, since the slowness of movement allowed the enemy to bring up his reserves. It is true that the first blow when well prepared and well backed up by artillery always succeeded, since the enemy, though warned of the imminence of the attack was always surprised to start with as regards the hour of launching the attack, but it is also a fact that after a few days the defence succeeded in bringing up powerful forces quite equal to those of the attacker. It is true that this struggle pinned the enemy down, and it is on this account that the two battles of Verdun and the Somme really constitute one, in spite of outward appearance.

The stubbornness of the defence of Verdun and the wearing down of the Germans which was its result, paved the way for our success on the Somme; conversely the successes on the Somme paved the way in their turn for those of October and December at Verdun. *Whatever else happened, two points were well emphasised by these offensives of 1916.*

(1). *Each time that the Memorandum of the 16th January had been applied* within the scope of its application, important successes had been brought off: for example: the first Colonial Army Corps at the beginning of July; the 7th Army Corps at Bouchavesne; Mangin's Army Group at Douamont and at Louvemont (24th October and 15th December, 1916).

(2). *Conversely, there was a fatal tendency in other operations* to reduce the extent of the frontage of attack; to choose too close

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objectives and to increase the pause between two successive assaults; the opportunity thereby given to the enemy to rally and to re-organise new lines of defence as fast as our advance progressed.

To sum up, these tactics, had not given a decisive result because they could not be properly applied.

Neither with the first effort since the artillery preparation could not reach the whole depth of the enemy defensive organisations.

Nor in the long run, since the superior power of the attack diminished in proportion as that of the defence increased and so everything degenerated into a war of attrition of both sides.

These different consideration led G.Q.G. to cancel the Memorandum of 16th January and to replace it by that of the 16th December 1916 (on the object and the conditions of a concerted offensive battle).

Previous fundamental principles still remained the same, since the battle of the Somme did not cast any doubts on the principles on which the tactics were founded. But it was considered essential to emphasise further the following points :—

(1). *Attacks must be carried out on as broad a front as possible*, and this is the only way that one can hope to reach distant objectives.

(2). *Attacks must be designed for the capture of the enemy's artillery position.* To this end the artillery must be pushed forward as far as possible, so as to enable an effective preparation against all the positions on which it can be brought to bear.

(3). *Successive attacks must be made with the shortest interval*, in order to exploit to the utmost results achieved. The changes of artillery positions must consequently be pre-arranged.

(4). *Finally, there is a need to pre-arrange and to plan out exploitation of successes* more thoroughly than before, and to organise it in such a way that it will be more speedy and more effective.

The year 1917.

The spring offensive (16th April). The doctrines thus enunciated appeared in 1917 to be capable of expansion. Our modern artillery equipments which commenced to be issued enabled the duration of preparation to be reduced, and lent themselves to quick and easy changes of position.

The increase in the number of guns, the increase in calibre, improvements in the shape of shells of which the supply became inexhaustible, more shattering explosives, gas shells, special gun carriages, the perfecting of means of observation and of fire control, everything was put in hand to make the gun a more and more accurate and powerful weapon. More Trench Mortars were provided, and the depth of the zones attacked by the artillery became very great *Then the possibilities of breaking the enemy* line on a wide front again came to the fore, and so the famous offensive of the spring of 1917 was mounted in the sector of the Aisne with the support of 2,000 heavy guns, of which 700 were modern, backed by more than 1,500 trench mortars. This grandiose operation disappointed all our hopes again;

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there is no doubt that a too great edifice had been planned, and the result called for, as much as the methods to bring it about, were not yet in harmony with the material means then at our disposal, notwithstanding their amplitude. Its check seemed to be due as far as artillery in particular was concerned.

(1). To the too numerous objectives allotted to the artillery in view of the number of its guns and of their allotment of ammunition.

(2). To its lack of guns with high trajectory fire, when the majority of the targets were such as could not be attacked by low trajectory fire.

(3). Finally, to the absence of any element of surprise.

In fact, the contending forces had got into a state of equal balance and the means employed could not yet give decisive results by the complete breaking of the enemy front.

Attacks with limited objectives of the end of the year 1917.

After our great offensive of the spring had proved abortive, General Petain, who had, on the 17th May, assumed command of the French armies, judged that, in consequence of the even balance of the opposing forces, and of the nearly complete defection of the Russian Army, it would be wiser to postpone the decisive battle for the time being, and to wait the completion of the developments that were being effected for our artillery till our troops were equipped with tanks now being built, and till America would be in a position to give us her valuable help by the dispatch of her ample man-power.

Without restricting our aggressive policy in the least he resolved therefore to attempt only the *wearing down of German* strength whilst husbanding our own resources by means *of attacks with limited objectives*, launched by surprise, with varying elements of time and space, and planned with big factors, especially artillery in sectors which the enemy was particularly desirous of holding.[1]

This need of employing operations on different and extended fronts called for as corollary, the preparation and organisation of numerous battle areas, and it was this that was *named the organisation of the front.*

It is on these ideas that the attacks of the second half of the year 1917 were planned : *the operations of the first army and of the British at Messines and in Flanders : attack of the 20th August at Verdun : attack on Malmaison, 23rd October.*

Well carried-out, carefully mounted, and well equipped for their purpose, they arrived fully at the desired goal; they yielded more than they cost and contributed greatly to the retention of the initiative in our hands.[2]

The operation of Malmaison in particular, mounted, it is true, with very powerful material factors, but with a limited objective and on a

[1] Summary of the introductions No. 1 of G.Q.G. (19th May, 1917).

[2] The operation of Verdun brought in 9000 prisoners, 30 guns, and 250 machine-guns.

The operation of Malmaison brought in 12,000 prisoner, 200 guns, and 750 machine-guns.

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restricted front—(12-km.)—afforded results of a strategic nature which we could scarcely have dared to hope for, thanks to the judicious choice of the selected point of attack; the enemy had indeed to abandon the whole crest of the Chemin des Dames, so bitterly fought for since the 16th April, and to withdraw their whole line to the north of the valley of the Ailette. Further since the enemy was waiting for us, surprise was non-existent, and thus it is proved that the tactics were sound.

The formula for the break-through battle towards the end of 1917.

At this period the problem of the break-through battle may be considered as virtually solved, and the solution was summed up in two Memoranda still in force: that of the 31st October, 1917, on the offensive, and that of the 20th December, 1917, on the defensive.

The doctrine of battle on the whole front is thus defined by these Memoranda.

"The battle comprises defensive actions and offensive actions closely bound up with one another.

"In the first the higher command, whilst maintaining constant pressure on the enemy, groups and reorganises its forces and its resources of every kind with a view to future major attacks.

"In the second it develops attacks, employing to the full the means which it has collected."

The principles. The general principle of 1915 and 1916 remains unaltered; the enemy front must be broken; but it will be broken by taking advantage of the chaos produced in the general dispositions of the enemy by offensive actions launched with suddenness and in an unexpected form, which will permit *the element of surprise to be made use of.*

"These offensive actions will first of all take the form of attacks with defined and limited objectives; they will be renewed and altered in the shortest possible time and in the greatest possible front in order to break up the fortified protection of the enemy. They will lead up to operations with a larger and larger scope, wherein the decisive phase of the battle and the pursuit of the hostile armies will in turn be envisaged." In this way armies must: *attack carefully* selected points with a view to the capture of limited objectives, so as to wear down the enemy.

(To be concluded.)

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ARTILLERY TRAINING FOR INDIAN PACK BATTERIES.

BY CAPTAIN R. L. O. CAREW, R.G.A.

THE following distribution has been tried, as an alternative to that described by Major Gale in the September issue of the R.A. Journal.

It is based on the following assumptions :—

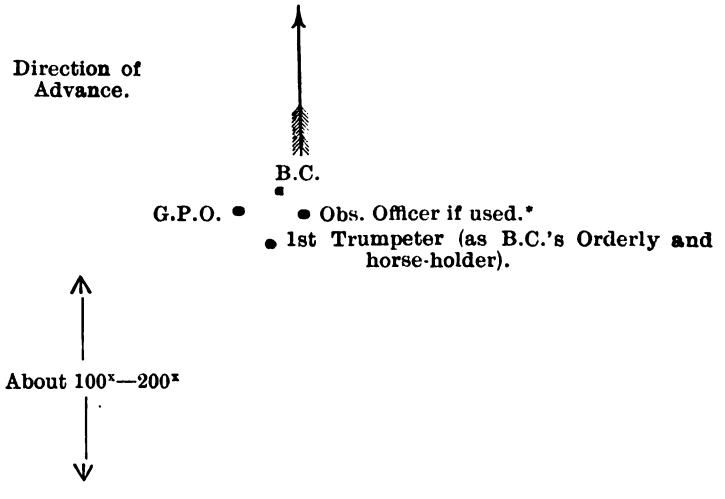
(1). That no one-man range-finder is available.

(2). That the six riding mules mentioned by Major Gale cannot be spared for the B.C's Staff.

(3). That on an average—one battery pony (out of the seventeen) may be taken as unfit for duty.

Distribution of Riding Ponies.

Indian Officers	4
Havildar Major	1
Quarter Master Havildar	1
Signalling Havildar	1
Salutri or Vety. Asst.	1
2 Trumpeters	2
2 Range-Takers	2
2 Mounted Signallers	2
2 Drivers as horse-holders	2
Spare (or sick)	1
Total ...	17



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Remainder of B.C.'s and G.P.O.'s parties under Havildar-Major.

- Havildar-Major.
- Signalling Havildar and 2 other Signallers.
- Two Range-takers.
- Two Drivers (horse-holders).

Extended if liable to come under fire.

Distance depends on circumstances.

- Captain.
- Driver I.O. (or Q.M.H.) and 2nd Trumpeter.

Distance according to circumstances.

- Bty Leader.*
- Dismounted Signallers and range-takers and telephone mule.

Battery.

- Driver Indian Officer and Salutri (or Vet. Asst.) and 1 or 2 dismounted signallers.

1st Line.

Distance according to circumstances.

- Q.M.H. or Driver I.O.

2nd Line Transport.

* If the B.C. employs a British Officer as "Observation Officer," the Battery Leader will have to be an Indian Officer (and *vicê versâ*).

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The distribution by parties was viz :—

B.C's party.

B.C. (and "Observation Officer" if required.)
Havildar Major (with director).
Signalling Havildar and one other signaller. (b).
2 Range-Takers.
1st Trumpeter and 1 Driver as horse-holders.

G.P.O's party.

G.P.O.
1 Signaller.
1 Driver as horse-holder (with director).

Captain's party.

Captain.
(Driver) Indian Officer (or Q.M.H.)
2nd Trumpeter as horse-holder.

The diagram on the preceding page is intended to represent, roughly, the battery advancing into action.

On arrival at the approximate position for the guns—the B.C. can indicate an area in which he wishes the battery brought into action, leave the G.P.O. with his party (see above) to select the actual position, and go on with the 1st Trumpeter, and followed by the remainder of his party, to reconnoitre his O.P. The disadvantage of this plan is that the G.P.O. has only one signaller with him to maintain communication with the B.C. until the dismounted signallers with the battery arrive, but this difficulty can be avoided by the G.P.O. himself acting as "writer-down."

The Havildar Major, Signalling Havildar and the other two mounted signallers (of the B.C's and G.P.O's parties, see above) are trained as B.C's Assistants, and it is a great advantage if the Havildar Major can signal himself, if not, and one of the Indian Officers is an ex-signalling instructor, it might be worth while to employ him (the I.O) as 'Observation Officer,' and it might be possible, in this case, to transfer the B.C's second mounted signaller ((b) see above) to the G.P.O's party, so that it will not be necessary for the G.P.O. to act as "writer-down." The "Observation Officer" (c.f. Medium Artillery), or second officer at the O.P., can be very useful to the B.C. on occasions—to reconnoitre lines of advance, act as liaison officer with the infantry if required, look out for new targets, etc.

In a Section by Section Retirement the procedure would be very similar to that described by Major Gale—the Captain, having sent off the 1st line under a (Driver) Indian Officer, would himself go back with the two mounted range-takers and 2nd Trumpeter (as horse-holder) and select successive positions for the sections. The B.C. with the 1st Trumpeter (as orderly) and one mounted signaller, moving from one section to another as required. The Havildar Major and Signalling Havildar could rejoin their sections and act as "B.C's Assistants" to

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the Section Commanders, or one of them might be retained with the B.C. if desired.

If there was no Captain, or, he was otherwise employed—the actual selection of successive positions would fall on the Section Commanders. Each Section Commander having seen his section out of its last position and indicated the direction of retirement to his Indian Officer, would go back as fast as the ground permitted with the two mounted range-takers and a horse-holder, select his next position and, having taken as many ranges as he considered necessary, send off the range-takers to join the other section.

It may sometimes be necessary in case of detached sections (as for example in a section-by-section retirement) that Sikh signallers or range-takers may have to work with the Mohammedan section or vice versa. Such men require thorough drilling otherwise confusion is probable.

The training of the Havildar Major, Signalling Havildar and some of the other signallers to act as B.C's Assistants should not present any very serious difficulties and can be usefully combined with "sand-range" for the Officers.

Major Gale mentions that Gunner and Driver Indian Officers *should* be able to perform each others duties—at present it is doubtful if the majority of them are. To remedy this, it might be possible to put selected Havildars (including Havildar Majors and Quarter-Master Havildars) of both the Gunner and Driver establishments, through some kind of course, which might end with a qualifying examination, before promotion to Jemadar.

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THE MILITARY CATASTROPHE.

(LUDENDORFF'S GUILT.)

A translation of the German work entitled: "Ludendorff's Guilt," and the "Military Catastrophe," written by Doctor Lehmann, who during the War was employed as a Surgeon in the Hospital at Rastatt.

BY LT.-COL. J. H. M. BEASLEY, D.S.O., R.G.A.

Dr. Lehmann worked out a plan for the successful conclusion of the War.

His main idea was a great offensive in the Western Theatre of War, the strategic objective being the separation of the English and the French Armies and the ultimate destruction of the British Army.

Dr. Lehmann, sent his plan to the Minister of War "General von Stein", on the 11.12.1917. Dr. Lehmann received an acknowledgement of his work from the Adjutant of the Minister of War on the 14.12.1917.

Whether his plans were actually made use of, is not known, at all events, they are interesting to read as an indication of the fate which was intended for the British Army.

Chapter I. of the Work gives Dr. Lehmann's plan.

Chapter II. extracts from Ludendorff's work: "My Memoirs of the War 1914-18.

Chapter III. Gives exposition of the similarity between Dr. Lehmann's and Ludendorff's Plans and a criticism of Ludendorff's actions.

CHAPTER I.

"Dr. Lehmann's arguments in favour of, and his plan for a great offensive against the British Army."

For two years I have been engaged on the solution of the task as to how a decisive victory could be brought about against the "British Army" in France.

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The course of events in the last two years, has shown us how very difficult it is to concentrate a large superiority of men and material in one particular part of the front, but it appears that the tide in the Eastern theatre of war has turned in our favour so that I now consider it possible to carry out a decisive operation.

It is essential for Germany to force a decision in the Western theatre before "America" can throw her weight into the scales.

The basic conditions for this undertaking are:

(1). Peace with Russia under all admissible circumstances.
(2). Financial and economic help for Russia.
(3). Relief of pressure on our Allies the "Turks."

The strengthening of our forces in the west would be greatly facilitated by the release of our troops in the east and the return of our best soldiers from captivity in Russia. The final military decision must come in the west; in this theatre there can be no possible talk of a "peace of agreement", for an agreement with England would mean giving in to her conditions; furthermore, an agreement is not necessary for England and a favourable decision is essential for Germany.

Our conquests in the east do not affect the interests of England to any great extent. Belgium and the north of France remain to be considered. England says to herself, "the possession of Germany's colonies is worth more to me than the possession of Belgium and the north of France is worth to Germany."

For Germany's future, her colonies are much more essential than the possession of Belgium and the north of France, as the lack of raw material, in conjunction with England's merciless economic policy, would lead to Germany's ruin.

The amount of territory won, the number of prisoners taken by the enemy, whilst attacking the essentially defensive positions of the German Army, have strengthened the morale of our opponents and their conviction in their military superiority.

England trusts in her "strength", France lives on "hope", so long as England remains on French territory there is no possibility of German gaining favourable "Peace Terms"; should America enter the arena, then our doom would be sealed.

The situation therefore demands:

1. Tremendous efforts in the West.
2. In our rear Russia eliminated.
3. Attacks undertaken in Mesopotamia and Palestine.
4. The Macedonian front to be carefully watched, and if possible the Italian front be shortened and held entirely by Austria.
5. Finally the decisive battle in the Western front be fought.

This battle must take place on the front between Lille and Soissons; "fifty divisions" will be required, the greater part of this force must be so distributed in the back areas, that the enemy does

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not become aware of any great preparations. All material brought to the front must be hidden from view, as much as possible, and protected from air attacks, etc.

At the appointed hour, which depends on the length of time necessary for preparations and a knowledge of the most favourable moment, the decisive attack must be made at the "junction of the French and British Armies."

To veil this attack and to render it successful, it will be necessary to hold the main French Army in its present position. For this purpose small offensives must be undertaken in Sundgau and in Lothringen, and on the front between Verdun and Rheims. Shortly afterwards the first preparatory attack must be made between La Fère and Corbeny strategic objective, Soissons and Compiegne. The new front must then extend from La Fère to Chauny over the hilly country to Noyon, from there to Compiègne, then east to Soissons, and from there to Vailly along the Aisne Canal to Corbeny.

This strategic move, in conjunction with the above mentioned two small offensives on the purely French front, would hold the main body of the French Army in the bend between Paris and Verdun and Belfort and would lead the French to believe that the German Army intended to march on Paris, thereby distracting the attention of the French General Staff, from the area north of Paris.

This pushing forward of our front in a S.W. direction would act as a protective flank for the intended main attack on the front, Croisilles and La-Fère.

The right wing of the new front would be liable to heavy attacks by the English Army. To relieve this pressure and for the safety and success of the main attack it will be necessary to carry out a second small attack between Warneton and Lens.

This attack would probably lead the English to believe that the capture of Calais was intended and in all probability they would concentrate the main body of their troops in this area.

The German troops must under all circumstances, hold this new front until the main attack has succeeded and relieved the pressure on their front.

No effort must be made to break through towards Calais, for such action would jeopardize the ultimate object of the operations, viz., the destruction of the "English Army", the main body of which would be driven south of the line Calais—Arras, whereas the object of this small attack is merely to keep the greater part of the English Army occupied on their front. Should these enterprises succeed, the main attack would then be delivered against the more or less weakly held front, 80 kilometers in length, between Croisilles and La Fère.

This attack would be delivered by three Armies :

The First—Between Croisilles, Villers—Guislain.

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The Second—Between Villers—Guislain, St. Quentin.

The Third—Between St. Quentin and La Fère to Noyon.

This attack must be carried out as strongly as possible, for on it depends the success or failure of the whole offensive. The strategic objective is to produce a salient 60 to 70 kilometers in depth.

The second phase of the main operation would be carried out in two parts :

1. An attack to deepen the salient to include the towns : Acheux, Doullens, Auxi-le-Chateau, St. Requier, Abbeville, Formerie, Marsolie, Froissy and Breteuil.

2. Simultaneously with this extention of front, a small attack must be made to join up Froissy with Compiègne.

The next stage of the main operation (providing that new reserves are always available) must be characterised by an attack on the now seriously threatened English front between Lillers, Lens, Acheux, Doullens, Auxi-le-Chateau.

A further attack must be made to occupy the territory between St. Pol, Hesdin, Montreuil, Etaples, in the north, the sea in the west, Formerie, Forges-les-Eaux, Neufchatel, Dieppe, in the south.

From the base now obtained the objective, that is to say "the destruction of the English Army", (which has been driven into the area Nieuport, Ypres, Lillers, St. Pol, Hesdin, Montreuil, Etaples, by concentrated attacks) would be achieved.

An attempt would doubtless be made to save a part of the English Army, by shipping it across the English Channel where it would be met by the concentrated attack of our U. Boats.

The whole coast from Dieppe to the Dutch Frontier would now be in our possession.

If sufficient reserves are available for a further attack the whole area between Dieppe, Le Havre, Rouen, Formerie, should be occupied.

The final German front facing the French would be a line from Laon to Le Havre. The net results of this military victory would be, the inclination of France to conclude Peace, in view of the destruction of the English Army, and the loss of the most valuable French Territory.

Should France however still refuse to conclude Peace, a further attack on Paris would be necessary.

The possession of the coast lines between Le Havre and the Dutch Frontier would be of great potential value in arranging terms of Peace with England.

The long expected assistance from America would now scarcely influence the military situation; Germany could conclude a Peace which would suit both her inner political situation and her future position as a world Power.

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CHAPTER II.

Dr. Lehmann quotes passages from Ludendorff's book "My War Memoirs 1914-18" and criticises his actions.

(LUDENDORFF'S MEMOIRS.)

The preparation for the attack in the West.

Ludendorff writes:

1. The situation at the end of 1917 was more favourable to us than might have been expected—through the fall of Russia, etc.

2. In what force the new formed American Army would come into the War, could not be accurately forseen, but it was evident that, in the Spring of 1918, the comparative strength of the opposing forces would be more in our favour than it would be later in the year, etc.

3. I held the view that Bulgaria would only remain true to us, so long as we could show that we were winning, etc.

4. The general situation with our Allies, demanded an early attack and decision.. This could only be brought about on the "West Front."

5. On the 2nd January, 1918, a conference was held in the presence of the Kaiser. It was proposed to attack with 50 or 60 Divisions (the final decision for the operation was taken later on, January 17th.)

6. The modern defensive battle is more costly than the attack. In the months of August, September, October, 1918, our losses were much heavier than in the months of March, April, and May of the same year, etc.

7. Many complaints were received from various quarters, with regard to the morale of the recruits of 1899 class, etc.

8. The strikes in Germany in January 1918; showed that the independent social democratic party was gaining much ground, and that the members were well under the control of their leaders.

"The attack in the West 1918."

9. The main attack had progressed well; in the centre, owing to strong resistance in the neighbourhood of Arras, this part of the offensive was not so successful and the strategic result of the whole operation was thereby affected. Had this operation succeeded it is probable that the French and English Armies would have been separated, and the English Army driven northwards against the coast.

10. It was decided to carry out a local attack from La Fère to assist the operations in the Cambrai salient.

11. Feint attacks and preparations for further attacks took place.

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(a) By the Army of the Crown Prince between Rheims and the Argonne.

(b) By the Army of von Gallwitz, on the old battlefields of Verdun.

(c) By the Army of Prince Albrecht between Saarburg, in Lothringen and Markirch and in Sundgau.

12. Extention of the attacks in a northerly direction towards Arras and in a southerly direction to the banks of the Oise were agreed upon.

13. On the 21st of March about 4 a.m., the battle commenced with a tremendous bombardment, on a 70 klm. front between Crosilles and La Fère.

14. The fighting strength of the 17th Army was soon exhausted on the 21st and 22nd. March. It had suffered severely, as it had fought on too narrow a front. It also stood under the pressure of the enemy's forces in the north, etc.

15. The enemy commenced to build up a new front N. of the Somme, the resistance was difficult to overcome, etc.

16. The enemy's power of resistance was increasing, and our forces did not appear strong enough to continue further attacks.

17. On the 4th April, the 2nd Army, and the right wing of the 18th Army attacked near Albert and the south of the Somme, in the direction of Amiens. These attacks were fruitless, it was becoming more evident that the enemy's resistance was too strong for us, and after much consultation with Army Commanders we were compelled to make the painful decision to stop the operation against Amiens.

18. Strategically, what was hoped for on 23rd, 24th, and 25th of March was not achieved, and it was a cruel blow for us not to have been able to take Amiens. The capture of this town would have rendered communication between the French and English Armies very difficult to maintain.

19. Our losses were not excessive, the percentage in the 17th Army was too high, and the loss of officers heavy.

20. On the 7th of April, the 7th Army attacked in the direction of Coucy la Ville, from Chauny and La Fère.

The French were driven back over the Oise—Aisne Canal, the long southern flank of the 18th Army was thereby better protected.

21. In spite of the U. Boat War I reckoned on the arrival of strong American reinforcements. The rapidity with which they came, surprised me.

22. Our losses, which could not easily be replaced, were beginning to make an impression.

23. Our troops had fought well, although some divisions in the Lys area had not shown an over-anxiety to attack; this made one think rather seriously.

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24. Our troops had captured large quantities of the enemy's provisions. Some of the units showed an inclination to stay with the newly found rations and the advance was accordingly delayed. Discipline was evidently lacking, so much so, that the young officers and company commanders did not feel themselves strong enough to assert their authority, and force the troops to go on.

25. The want of officers of the Old Officers Corps was keenly felt.

26. It became necessary to form "Punishment Companies", these were put in the front line and forced to work. "Is not this a sad story."

27. After conversation with various officers of all grades, it was clear to me that the discipline of the Army was being undermined by the people at home, and as an instrument of war it was rapidly degenerating, etc.

(The paragraphs are numbered for future reference.)

CHAPTER III.

(Dr. Lehmann's criticisms of the above paragraphs, now follow.)

Any one who has read Ludendorff's Memoirs cannot help admiring the manner in which, in the short space of three months, he thought out, and carried out, his great task exact to the minute, up to the moment of the attack.

In spite of all, there was a great mistake, which no further attacks could rectify. Is it not clearly visible also, on reading the previous passages (Ludendorffs Memoirs) that a disease had crept into the formerly sound body of the German Army.

Had Ludendorff not recognised this? or did he think the Army could be remade into a sound military machine?

Nevertheless, there is a tone of doubt and resignation in Ludendorff's words "ought I to ask the Army to make further attacks."

However, he did it, to the destruction of the Army and the nation.

I will endeavour to show to what extent he is guilty of error. Scarcely anyone who has read my work, and also Ludendorffs, will deny that similarities exist, and in some cases the plans are 'identical.'

It must be admitted, however, that the plans for the great attack in March 1918, had probably been settled upon, before the end of the year 1917. Nevertheless, it must be borne in mind that in two individuals, who had never met, there existed the same ideas and corresponding plans for putting them into execution.

I must here mention, that it *is* possible, that Ludendorff actually made use of my work. It is equally possible, of course, that he did not "see" it, but only "heard" of it; whether he *actually* made use of my ideas, I do not know.

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Here follows in tabular form; my ideas and those of Ludendorff's; the similarity is somewhat striking.

LEHMANN. 11th December, 1917.	LUDENDORFF. January—April, 1918.
Arrival of my plans at the War Office middle of December, 1917.	Preparations for the attack 20th December, 1917.
Russia's exit.	Russia's exit. (1).
Favourable time before arrival of America.	Comparative strengths more favourable in spring, before arrival of Americans. (2).
Necessity of an attack in the West.	Necessity of an attack in the West. (4).
Conditional, on Peace with Russia.	Conditions, "Peace with Russia."
Attack requires 50 Divisions.	Attack requires 50 Divisions. (5).
Attack at the junction of the French and English Armies, rolling up of English northwards to the coast.	Divide the English and French Armies, drive the English Army to the coast. (9).
Feint attacks on the purely French front RHEIMS VERDUN in Lothringen and Sundgau.	Feint attacks near RHEIMS and in the ARGONNE by VERDUN, in Lothringen and Sundgau. (12).
The decisive attack to take place on the 70 kilom. front between CROISILLES and LA FERE.	On the 21st March, the battle commenced on 70 kilom. front between CROISILLES and LA FERE. (13).
Attacks with 3 Armies.	Attack with 3 Armies.
IIIa. CROISILLES to VILLERS-GUISLAIN.	17th Army, CROISILLES to VILLERS-GUISLAIN.
IIIb. VILLERS-GUISLAIN to ST. QUENTIN.	2nd Army, VILLERS to ST. QUENTIN.
IIIc. ST. QUENTIN to LA FERE.	18th Army, ST. QUENTIN to LA FERE.
Strategic objective AMIENS.	Strategic objective, AMIENS. (18).
For safety of southern flank, preparatory attack by COMPIEGNE Map I.	On April the 6th, attack in direction of COUCY-la-VILLE. objective, COMPIEGNE.
Second preparatory attack, between WARNETON and LENS.	Attack by the 17th. Army in direction of ARRAS.

(The numbers in brackets refer to Chapter II)

In view of the striking similarity of the above sequence of ideas, I may be permitted to ask, "Did Ludendorff use my plans?"

For what reason did he carry out his attacks "eccentrically"? i.e. first in the direction of Amiens, and then in a northerly and southerly direction.

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1. Ludendorff actually made his attack on Amiens, on 21.2.1918.
2. His attack in a northerly direction against Kemmel, on the 9.4.1918.
3. His attack in the south, against Chateau-Thierry on the 27.5.1918.

My idea was just the reverse; I pointed out the necessity of first attacking "concentrically" in the north and south and, finally, in the centre. My attacks north and south correspond almost exactly with Ludendorff's, the only difference being that I insisted on their being carried out before the large offensive against Amiens.

One may well ask, "why did Ludendorff's great attack fail"?

Why was the objective the "sea coast", "the destruction of the English Army", and with it a certain end of the War—not achieved.

The answer to these questions is, that certain essential factors were not taken into account.

1st. The situation demanded "decisive" and "quick" victory.

2nd. The coast must under all circumstances be reached, otherwise, any other success would be only "tactical" and in reality a "failure."

3rd The enemy knew that it was our last effort, the resistance of our opponents was hardened through the general feeling of hatred against the "Boche"; clever enemy propaganda, together with our useless air attacks on London and shooting on Paris, increased this feeling of animosity.

4th. The higher intelligence of the Western Nations as compared with the Eastern, their discipline and leading, their inexhaustible supply of material, these factors, so little considered, gave the Franco-British Army a strength which could not be overcome by a single blow.

5th. The safety of our flanks, which was necessary for the success of the main operation, was not attended to, and the consequences were soon noticable, (compare Ludendorff's remarks in 14, pressure on Flank of 17th Army. "The enemy very soon realized the objective of our attack." Compare Ludendorff's 15. "The enemy began to build a new front N. of the Somme.")

So long as the enemy's forces in the north and south were not held in their position, our troops were bound to be brought to a standstill. Ludendorff writes: "it was evident that the enemy's resistance was stronger than our attacking power" etc.

Having carefully considered all factors, I cannot help coming to the conclusion, that with the failure to safeguard both flanks, in the north and south, the achievement of the task was impossible.

Had Ludendorff undertaken the attack on my lines the flank of the 18th Army would have been secure, and it would probably have succeeded in driving the English Army northwards. Furthermore the attack which I suggested N. of Arras would have held the enemy's forces in their positions and prevented them from bringing pressure on the right flank of the 17th Army; Ludendorff admits that this pressure seriously affected the success of the whole operation.

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Here lay the great mistake.

The relief of pressure on the 17th army would probably have ensured the success of the whole operation, Amiens might have fallen; the important junction of the French and the English Armies would have been severed and the possission of the sea coast and the end of the War were then, within the region of possibilities.

Ludendorff says that the 8th of August 1918, was the "blackest day" for the German Army in the whole history of the War.

I do not agree; the 4th April 1918, was the turning point. The great battle, on which Luddendorff had put all his hopes had failed; "Amiens" was not captured.

Did Ludendorff really think that after this day, with physically and morally weakened troops and with used up material, he could destroy an enemy that daily received fresh reserves.

Had Ludendorff still any doubts as to the ultimate result, he should immedately have forbidden further offensive operations.

He knew quite well that he had to reckon with the arrival of American troops, while he admitted heavy losses; there were also other reasons.

(a). Austria's weakness.

(b). Unreliability of Bulgaria.

(c). Signs of dissension in Germany and growing strength of independent socialists.

(d). The weak morale of the new recruits.

(e). Weakening of authority of officers, and poor discipline.

(f). The necessity of forming "punishment companies" etc.

Did Ludendorff banish all these thoughts from his mind? or was he actually unconsious of the danger?

To those who were aware of these factors, the unsuccessful issue of the operation was no surprise.

The final act of the drama developed with rapidity.

The battle of Armentières in April, together with the failure at Givenchy and Festubert, owing to the refusal of some divisions to advance to the attack, were extremely costly, and only a small tactical success.

The next attack down to the Marne in May was a brilliant effort, but turned out only to be a snare.

Foch counter-attacked. Clemenceau's remarks at this period are worth quoting. "I shall fight in front of Paris; I shall fight in Paris; I shall fight behind Paris, back to the Pyrenees."

The fall of Paris itself would not have ended the War as long as the French Army could be reinforced by fresh English and American troops.

A further attack was undertaken on both sides of Rheims, begun on the 15th July, stopped on the 16th, and retreat ordered on the 17th July. What an adventure!!!

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In spite of all this, the Army of Kronprinz Rupprecht carried out another attack in Flanders, although it was evident the enemy showed no weakness in this area.

All useless sacrifice!!!

On the 18th July the sound of the enemy's advancing Tanks was heard, the end of the great tragedy was drawing nigh. Foch had recognised the right moment, now he used it, "our fate was sealed".

It is interesting to note that in the middle of July 1918 Herr von Hintze, asked the chief of the General Staff, if he was sure "of a decisive victory in the present offensive"; to this question Ludendorff replied, most decidedly "Yes". On the 18th July, Foch began his work of destruction.

What an irony of circumstances!!!

How could Ludendorff possibly answer "Yes". Had not his plans already failed? Had he so soon forgotten Amiens, Kemmel, the Marne, Rheims? Did he really think that with a morally and physically weakened Army he could conquer a well equipped enemy? I am at a loss to know what to think of Ludendorff at this juncture.

He had certainly done wonders during the War, the eyes of the whole civilised world were upon him, he appeared to be incapable of making a mistake, perhaps he really thought he was.

The success of his great attack in the west was, as he thought a certainty. The first failures, gentle warnings; did he disregard them entirely. He was doubtless tired, he had worked hard for many years. He believed in victory, although cool reasoning would have shown him the game was lost. He believed, because he wished to believe. His "wish" mastered everything. It conquered Logic and Reason.

The 4th of April should have been the date on which he changed his views, and decided.

(a). To make no more attacks.
(b). To stand on the defensive.
(c). To commence delicate diplomatic discussions.

At that time he had in his hand, an Army still capable of fighting, a powerful instrument for making terms of Peace. With careful propaganda at home and an explanation of the situation, the mass of the people would have been held together until a peace could be arranged.

The peace terms, would undoubtedly have been hard, probably.

(a). Loss of territory.
(b). An indemnity.
(c). Possibly other not too pleasant conditions.

But Germany, although, smaller in area; would have preserved her strength, her Army, and saved for herself many uselessly sacrificed lives. "Rest" and "Work" might have led the Nation to a brighter Future.

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AN EXPERIMENT IN THE MOTORIZATION OF FIELD ARTILLERY.

BY MAJ.-GENL. SIR J. E. W. HEADLAM, K.B.E., C.B., D.S.O.

The admirable series of Essays recently published in these columns have thrown much light on the possibilities of Motor Transport for Artillery; though the writers were handicapped by lack of experience with up-to-date equipment. It is understood that this experience is now being obtained, but, since it is unlikely that the result will be published, some account of a similar trial in America may be worth the attention of those readers of the Journal who are interested— and who is not?—in the Motorization of Artillery.

Thanks to the excellent American custom of issuing to the Regimental Journals such official papers as are of general interest, we may now read in the United States Field Artillery Journal the Report of Major Pennell, who commanded the 1st Field Artillery* throughout the experiment—in which the Regiment marched over 75,000 "tractor miles" and fired approximately 80,000 rounds. In an editorial note his Report is stated to be "the best paper written thus far upon the subject." It is certainly a very out-spoken document, and the conculsions reached are obviously the result of conscientious endeavour to get at the heart of things. As he says in his covering letter to the Chief of Field Artillery, the opinions expressed are based to a great extent upon observations and conversations with tractor drivers, mechanics, motor serjeants, and battery officers. They are the men who really know the reasons! The importance attached to the *personal factor* throughout the Report is indeed its most striking feature—in refreshing contrast to a good deal that has been written on the subject of "Mechanical Warfare."

It must not be thought, however, that technical considerations are neglected. Such is far from being the case, as those who read the Report will see. But such matters do not bear condensation, and it is, therefore, only proposed in this notice to touch upon the more general conclusions reached.

* An American Field Artillery *Regiment* consists of two *Battalions*, each of three *Batteries*. Four such regiments were motorized for the trial, which has been going on since 1919.

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COMPARISON OF TRACTOR-DRAUGHT WITH HORSE-DRAUGHT.

The conclusions arrived at by Major Pennell in comparing the two forms of draught are rather at variance with those based upon theoretical considerations especially as regards their respective requirements in transport, road-space, and man-power.

Transport. The petrol expenditure of the Regiment was from 135 to 150 gallons per mile, including losses by evaporation, leakage, etc., and oil and grease consumption ran to from one-tenth to one-fifteenth of the petrol consumption. Taking into account the requirement for spare parts, it was found that the common idea that fuel would require less transport than forage was unfounded. Major Pennell considers that more transport will probably be necessary in a Division whose artillery is tractor-drawn than in one where it is horse-drawn.

Road-space. Similarly as regards road-space, where an advantage is so often claimed for the tractor. Owing to the necessity of halting to change gears the column is said to become "like an accordeon" on hilly ground, and though in normal circumstances the road-space covered should be no more with tractors than with horses, experience shows that, unless the march discipline is good, the loss of distance is excessive, and is very hard to check, owing to the many excuses available to the tractor driver!

Man-power. Tractor-draught is, however, undoubtedly economical in the man-power required for its actual working. It is also economical in its man-power required for its maintenance so long as the personnel is well trained. But if manned by poorly trained or disciplined personnel, tractor-drawn artillery will be found very extravagant in the man-power required for its maintenance.

MATERIEL.

In considering the equipment of Motorized Artillery it is important to realise that the organization of the battery, brigade, etc., as fighting units need not follow the same lines that experience has shown to be the most suitable for them when horse-drawn. Different conditions require different treatment for the accomplishment of the same result. The order of march, and the method of reconnoitring and occupying positions will, in particular, require variations from the present procedure to adapt them to tractor conditions, and this will effect the organization of battery and brigade staffs. For instance a full establishment of riding horses had been retained for the trial, but it was soon found that a mixed horse and tractor organization was not a practical arrangement, and the horses were never used for the purpose for which they had been issued.

In order to avoid unnecessary complications in maintenance and supply, only two types of power-driven vehicles should be provided—caterpillar tractors and a passenger-carrying vehicle of comparatively high speed. No change would, in Major Pennell's opinion, do more

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to make tractorization a practical success than the entire elimination of lorries—including the "F.W.D." They should be replaced by 4-wheel trailers, drawn by the same pattern of tractor as used for the guns. Such light repair and delivery vans as are required in addition to these trailers should be on the same chassis as the passenger cars, and therefore identical with them as regards mobility and upkeep.

Tractors. Two sizes of caterpillar tractors were issued for trial, a 2½-ton and a 5-ton. Owing to poor design and structural weakness the former proved unsatisfactory, but in any case Major Pennell considers that the 5-ton tractor is not too heavy for field artillery. It can take a gun* and wagon, or two wagons, practically anywhere, and has sufficient reserve of power to take an extra vehicle on the march in the event of a tractor going out of commission. Three pair of wheels is, however, too much for a normal load, on account both of the actual weight and of the difficulty of manœuvring.

Excessive speed is not necessary, and is ruinously extravagant in weight, durability, and fuel expenditure. The maximum need not exceed ten miles, but the tractor should be able to maintain that speed continuously. Above all "The Field Artillery pleads with the designer "to make reliability and simplicity his key-note in design. The "advantages of tractors which run on wheels or crawl on tracks, which "float as boats or carry loads as trucks, whose engines will operate as "submarines, or whose armour will turn any projectile smaller than "the 75, are fully appreciated, and each of these characteristics is "desirable at times. Yet we know that every one of them is purchased "at the price of excessive weight, extra power demands, inaccessibility "and complication of parts, and reduction of reliability on the march. "The Field Artillery needs a tractor capable of a train schedule per-"formance day after day, simple in all its parts, easily maintained, "stripped of useless or little needed attachments."

But he would add suitable arrangements for the No. 1's kit, so that he may be comfortable on the march, and a bracket for the "Guidon". It is good to remember that men are not machines—even in a motorized artillery!

Trailers. The trailers for the carriage of personnel, stores, etc., in place of lorries have already been referred to. The use of caterpillar treads for these trailers is not recommended at present because of the great increase of weight necessitated by their use, the difficulty of steering, and the impossibility of man-handling vehicles so fitted.

Passenger-carrying Vehicles. The important thing about the *motor-car* is that all those in a Regiment should be of the same pattern —any light 5-seater will do. As regards *motor-bicycles*, the present type were found to be of no use in batteries, and of little use in the regiment, except for despatch-riders, to whom they should be restricted. They can not travel at the same speed as tractors, and towing tears them to pieces, besides tiring out the rider, so that they are quite out

* The guns and wagons were rubber-tyred, and no limbers were used.

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of the question for Section Commanders, Nos. 1, or anyone whose place in the column is more or less fixed. For messenger work in batteries what is required is an ordinary "push" bicycle, or a very light motor-bicycle, which can be picked up by one man and hung on brackets on the side of a tractor or back of a wagon. Is should be always carried in this way except when the rider has to leave the column.

Repairs. Major Pennell insists that, however skilful and willing the Ordnance mechanics may be, repairs are much better done regimentally. The interest of an Ordnance Workshop must be to "get the job out", while the regimental artificer is in effect the user. If the work is poor "that same mechanic is the man who is going to be up all night putting it right, and the officer in charge of the (regimental) shop is going to be along to receive the blessing of the Regimental Commander if everything goes fine."

PERSONNEL.

Throughout his Report, Major Pennell has obviously had the importance of the personal factor ever in his mind. It crops up again and again. And when he comes to the crucial question of the reliability of the tractor, he states plainly that it is not merely a mechanical matter, but largely one of the training of the personnel—so much so indeed that the reliability of the machine may be said to increase as the square of the training of the man. In fact the development of the tractor is in advance of the ability of the Field Artillery to take advantage of it. It all comes back of course to the officers in the end, and many of them, he says, appear to think that in a tractor regiment "one travels in a limousine, sleeps in a motor bungalow de luxe, and presses a button to start the column in the morning." They are also divided to a large extent into hostile camps—either very strongly anti-horse or anti-tractor. Can we not apply all this nearer home? And must we not agree that "the Field Artillery would be neglectful of its opportunities did it allow prejudice or sentiment to interfere with its search for the bast motive power for its weapons"?

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ARTILLERY TACTICS.

Translation of an Article by Lt.-Col. Frhr. V. Weiterhausen in the Militär Wochenblatt of August 28th, 1920.

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

"The French have now opened in Metz a Central Establishment for artillery studies for the training of generals and higher officers of the artillery and other arms. The artillery was always their pet arm and they are now showing that they are willing to preserve the lessons of the war, to perfect them, and to make them common property. The value of the tactics of artillery compared with that of the other arms has risen extraordinarily in the war. The artillery is no longer a close guild. To-day everyone who wishes to be a leader, must interest himself in it and master it. In Prussia, the artillery was always rather neglected. The infantry was the queen of the arms. All tactics were adapted to them; everything else had to give way to them. That cost us much blood in 1870-71 and, sad to say, yet more in the World War. Bitter necessity, after monstrous losses, brought the artillery the importance it should have had long ago.

It is, therefore, no wonder that our gunnery was not all it should have been before the World War. In addition to the lack of interest in this arm taken by higher commands, there was the division of Field and Foot Artillery with their sharp differences. While the Field Artillery with difficulty weaned themselves from the tactics, which they had used in their famous fights in the war of 1870/71, and hesitatingly took into account the enormous progress of technique; the Foot Artillery had come on remarkably, especially in the last decade. Since their chief task, after their speciality of fortress warfare, lay in dealing with fortified field positions, they, and almost only they, made use of their experience of engaging hidden targets from covered positions, without this becoming the common property of the whole artillery.

Unfortunately ,the Field Artillery did not realise to the same extent the importance of this development; the significance of "errors of the day" and "of the gun" remained unknown to them. They held too strongly to the principle of engaging the target with direct observation. Shooting by the map was unknown to them. This also led to neglect of long ranges, at which direct observation was too difficult or no longer possible. It also prevented the echelonning and breaking up of artillery groups in depth and led to adherence to putting artillery in mass in more or less long rigid lines. Perhaps also the Jüterbog

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manœuvre ground, the training ground of our Gunnery School, with its long narrow troughs and ridges, made it more difficult for us to entirely shake off the artillery tactics of bygone days.

Our estimates for ammunition also doubtless influenced the demand for engaging a target with direct observation unfavourably. One asked "With how little ammunition can I successfully engage a target in the shortest time?" instead of putting to oneself the question "With what a hail of iron do I cover an area in the shortest time, so that a target reported there is successfully dealt with?". Then, perhaps, a different provision of ammunition would have been arrived at.

The French had drawn other conclusions from their recoil-gun with its splendid sighting apparatus and an excellent system of range-finding. They preferred splitting up the artillery, arranging it in groups with special tasks; shooting by the map and plying the target with massed fire. This way of using their artillery also led them to closer touch with their infantry. We lacked this at the beginning of the war, which caused us painful losses.

Then came the great rise of the Artillery. Field and Foot Artillery were amalgamated; all barriers fell. Thereby a strict fire-control was at last made possible and the perfection of the arm hastened. Allowance for the errors of the gun and of the day became the daily bread of the artilleryman. Intelligence and command systems came at last under one head. Flash-ranging, sound-ranging, meteorological, topographical, balloon, and flying, detachments became the indispensable assistants of the artilleryman. Hence it became possible to direct big masses of artillery as a unit in rolling fire, destructive fire, etc. The artillery liaison officers and the establishment of infantry and artillery commanders beside each other, achieved that intimate and pliant co-operation, which is the keystone of the smallest success. So the sister arms learnt to understand and value each other in the hard hour of necessity and death and the barrier of mutual non-comprehension had fallen."

Then follows a complaint that the "Treaty of Disgrace" has prevented Germany from working out the artillery lessons of the war as the French are doing. The Germans, therefore, have only the lessons of the front. "Knowledge of each other's arms and mutual understanding must be produced by long attachment of infantry, cavalry, and artillery officers to the corresponding sister-arms, not only in the lower, but in the higher, ranks. Especially in these higher ranks must the future leaders be given an opportunity, by long independent command of the sister-arm, to work themselves into it and learn to understand it. Joint practices, even on a small scale, at all times of the year must be in the regular programme of all units. The artillery must get away from the drill ground more than before the war. Exact, formal drill took up too much time. They must get out in the country and with plane-table, director, and protractor, practice all principles of shooting, as often as possible with live rounds—with practice rounds, which do not necessitate extensive closing of areas. Every officer and N.C.O. must be familiar with the principles of shooting, be able to

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pick up a target and to shoot. Fire-control with the aid of full intelligence system cannot often enough be practised in the country and made the subject of detailed discussion. But this must not all be done as in a secret guild, but rather in connection with other arms, in order that, by continued mutual exchange of thought, the arms grow together learn to understand each other, and amalgamate to form one whole.

Artillery tactics are to-day on a par of importance with those of other troops. The Artillery is no longer a special or auxiliary arm, but a principal arm, which is quite the equal of the infantry. Only a close co-operation of these two arms will bring us the victory in future wars. Naturally the same is true for the cavalry. Their liaison with the artillery depends on the same principles as for the infantry; it is therefore superfluous to discuss it here. The experience which we have gained in the World War must not be lost to us and it can be retained, even by the miserable remains of our proud artillery left us by the "Treaty of Disgrace"."

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DRILL AND DISCIPLINE IN THE ROYAL REGIMENT.

BY LIEUT. G. L. APPLETON, R.G.A.

IT is generally admitted that in many units of the Regiment the general standard of discipline and smartness which prevailed before the war has not yet been recovered. It would seem that a large step towards recovery would be made by a greater insistance on a thorough grounding in smart foot-drill and physical drill, on which superficial discipline, at least, almost entirely depends. It is a platitude that the soldierly and smart personal appearance of the man, which re-acts so vitally on his mental attitude, is entirely dependent on his thorough preliminary training on the barrack square.

There is a tendency at present in many units to accept a recruit from a depôt as if his preliminary training were complete, whereas he has had, as a rule, only a very cursory course of instruction. Added to this is the fact that many young officers and other ranks who joined during the war had next to no instruction in foot-drill, physical drill, and discipline generally. The result is that general smartness and discipline, both mounted and dismounted, is often not as good as it might be.

It is suggested that a remedy might be found by starting from bed-rock, and, as a preliminary measure, by spending a far greater number of hours in foot-drill.

During the war everything but essentials was necessarily waived. As long as the gunner could shoot his piece and move it with moderate efficiency little more was asked of him. There is some danger of this attitude becoming a tradition. Training in the Regiment is mainly devoted to technical matters, and this is as it should be : but one should not lose sight of the fact that a sound grounding in the early training which the recruit of every arm should receive, and the mental alertness which results therefrom, makes the later technical training far more easy both for instructor and pupil, and ultimately produces a more efficient soldier.

Assuming the necessity for a greater insistence on preliminary training, it is maintained that, for barrack square purposes, infantry drill and more especially "Guards' drill", has great advantages over dismounted cavalry drill, particularly in movements on the march. Many officers have viewed with regret the substitution of dismounted cavalry squad drill for infantry squad drill in Artillery Training, Vol. I. The advantage of having one form of drill both mounted and dismounted is more than counterbalanced by the inherent loss in smart

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movement, which is so valuable in the training of the recruit. Infantry squad drill insists on smart precise movements, whereas cavalry squad drill, based as it is on the movements of the horse, cannot but be a makeshift on foot and consequently lends itself to ragged movement and lack of precision generally. To many officers the outstanding memories of their training at the "Shop" is the tradition of strict discipline and smart foot drill largely based on the training of the Guards drill instructors. The average young officer joins his battery full of keenness and enthusiasm to pass on to his section the smartness and finish of his late company at the "Shop." Often he has a fair measure of success, but in the majority of instances he is brought up against the fact that neither N.C.O's or men have had the preliminary grounding in foot-drill and discipline upon which the structure of a smart section, and therefore battery, depends. No time is available to allow him to go back to preliminary drill with his section, and even if there was, his good intentions would probably be frustrated by the somewhat natural if shortsighted passive resistance of his N.C.O's and men.

If this preliminary training for all ranks is now necessary as a special and temporary post-war measure, and everything points to it, it must be the subject of normal orders and directions from higher authority. By this means alone can anything effective be done.

Junior officers and N.C.O's should be taken in hand first and thoroughly trained in foot-drill and barrack square work. Special courses of foot-drill and physical drill could be started for R.A. N.C.O's, or attachments arranged with Guards' Depôts and first class line regiments. Besides smartening up their ideas of drill and discipline it would give them a wider military outlook and promote that liaison and sympathy between arms the importance of which is now so much emphasised.

The experimental mechanicalization of the 9th Field Artillery Brigade foreshadows the gradual disappearance of the horse from the R.F.A. as well as the R.G.A. Bereft of his horse and all the smart turn-out which a horse equipment necessitates, the gunner, once more a foot-soldier, and concerned as he will be in the future with the less picturesque machine, should devote his attention to personal smartness and drill on infantry lines, to ensure that, while becoming a mechanic he also remains a soldier in every sense.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires—Feb., 1922.

I. Operations of the Belgian Army. (Continued).

II. Tactical security. Lt.-Col. van Emelen (additional Notes to articles in this journal of Oct., Nov., Dec. 1921.)

IV. Belgian and French Aviation on the Western Front. Cap. Comdt. Desmet.

VI. Mobilization of the Nation for War. IV. Cap. Comdt. Dendal.

VII. Review of recent Italian publications on ballistics. L. Godeaux.

IX. The Washington Conference.

France.

Revue Militaire Générale—Jan. 1922.

I. The Cavalry we require. Gen. Robillot.

A very interesting article. Gén. Robillot commences by saying that the retention of an unnecessary arm in these hard times for reasons of tradition is unjustifiable. He then discusses the following problem "Are there tasks that, with material in its present state of development, must still be carried out only by cavalry". After discussing most clearly the use of cavalry in covering mobilisation, as a screen during operations, its action against the flanks and rear of the enemy—the use of the Corps Cavalry, and the Strategical Reserve—Cavalry in pursuit—action against cavalry, etc., he goes on to the organisation, doctrine, etc., and finally arrives at the conclusion that a strong cavalry force, well trained to fight on foot and on horseback is necessary and that it should be so well equipped in transport that it could march the very hour mobilisation was ordered if not before.

He concludes "When in a future which I cannot as yet foresee the progress of science allows us to replace cavalry by a quicker, more supple, more powerful arm, providing at the same time a more economical and more efficient means of carrying out the tasks now undertaken by cavalry, I shall be the first to demand the suppression of the latter."

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II. The recasting of regulations and our war doctrine. (Continued.) Lucius.

This period deals with the situation after Nivelle's check and the various instructions given by the General in Chief on offensive actions with limited objectives.

The Battles of Messines, the Flanders offensive July 31st, the offensive of Aug. 20th N. of Verdun—of La-Malmaison, Oct. 23—of Cambrai Nov. 20 are briefly described and lessons deduced from them.

III. Strategy and Operations Ch. VI. Capt. Kuntz.

IV. The trench of "Thirst"—An episode in the fighting about Saint Mihiel. Gén. Cordonnier.

V. The French Cavalry during the first three months of the war. Col. Monsenergue.

Revue d'Artillerie—Feb. 1922.

I. The danger to our own troops from Artillery Fire. Lt.-Col. Tournaire.

This article refers to a book recently published—*Le Massacre de notre infanterie*—by Gén. Percin. The writer considers this book much exaggerated. It is based on the evidence of combatants but this evidence is not always reliable. Instead of collecting statistics of regrettable incidents, it is wiser to find the means of preventing their occurence in the future.

II. Technical advisers to the Command.

III. The end and the means. Maj. Menjaud.

IV. The Artillery Intelligence Service. Maj. Appffel.

V. The German Artillery in the "Break-through" battles of of the Great War. Col. Muller.

A lecture to the Officers of the 13th Divisional Artillery on the lessons to be got from Col. Bruchmüller's book "Die deutsche Artillerie in den Durchbruchschlachten des Weltkrieges."

VI. The German Firing Manual of Dec. 4. 1919. (Continued).

Miscellaneous Notes.—Germany : Employment of Artillery.
Austria Hungary : Infantry Guns.

Switzerland.

Revue Militaire Suisse—Jan. 1922.

I. Rapidity in attack, during and after the Great War. (Continued.) Jean Fleurier.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Die Marzoffensive 1918 and der Westfront. Strategie oder Tactik. By Major Otto Fehr. Leipzig (Koehker) 1921.

Official History of Australia in the War, 1914-18. The Story of Anzac from the outbreak of war to the end of the first phase of the Gallipoli Campaign, 4th May 1915. Volume I. By C. W. Bean. Sydney (Angus & Robertson) 1921.

Ballistique Interieure. By General Gossot and M. Liouville. Paris (J. B. Baillieure et Fils) 1922.

The Desert Mounted Corps. An account of the Cavalry Operations in Palestine and Syria, 1917-18. By Lieut.-Col. The Hon. R. M. P. Preston, late R.A. London (Constable) 1921. (Presented by the Author).

Geschichte des Krieges, Vols. I. & II. By Hermann Stegemann. Stuttgart (Deutsche Berlag-Unstalt) 1918.

Der Grosse Krieg in Einzeldarftellungen :—

Vol. 5.—Die Schlacht bei Mons.

Vol. 10.—Die Schlacht an der Yser und bei Ypern, 1914.

Vol. 19.—Die Schlacht bei Lodz.

Oldenburg (Stalling) 1918-19. (Presented by Maj.-Genl. The Hon. Sir F. R. Bingham, K.C.M.G., C.B.).

Marshal Ferdinand Foch : His Life and his theory of Modern War. By A. Hilliard Atteridge. London (Skeffington) 1918.

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REGIMENTAL LIST. The following Postings have occurred during the period 16th January, 1922, to 15th February, 1922.

Postings.—R.H. and R.F.A.

Alves, Major (Bt. Lt.-Col.) H. M. J., D.S.O., from Staff T.A., to 70/34th Bde. 2/2/22.
Armstrong, 2nd Lieut. P. F. B. N., from R.M.A. (1st appointment) to 72/7th Bde. 14/2/22.
Bather, Capt. E. J., D.S.O., from 37th Bde., to Adjt. 37th Bde. 26/1/22.
Beale, Lieut. C. J., from Att. Irish Cd., to 4th Bde. 26/1/22.
Bland, 2nd Lieut. H. O. C., from R.M.A. (1st appointment), to 88/14th Bde. 14/2/22.
Butler, Major W. V. H., from 10th Bde., to 141/26th Bde. 21/1/22.
Carden, 2nd Lieut. R. H. L., from R.M.A. (1st appointment), to 39/19th Bde. 14/2/22.
Chalker, Lieut. J., from Att. Irish Cd., to 2nd Bde. 26/1/22.
Colchester, 2nd Lieut. G., from R.M.A. (1st appointment), to 38/14th Bde. 14/2/22.
Cooke, Lieut. R. G., from Staff (Constantinople), to V. Res. Bde. 9/2/22.
Cullum, Major E. G. L., from Staff, to Att. IV. Res. Bde. 29/10/21.
Curtois, Lieut. J. R. W., from Att. Irish Cd., to 1st Bde. 26/1/22.
deRobeck, Lieut. B. L., M.C., from 19th Bde., to "J" Batty., R.H.A. 25/1/22.
Dalton, 2nd Lieut. C. J. G., from R.M.A. (1st appointment), to 77/6th Bde. 14/2/22.
Daniell, 2nd Lieut. R. B. T., from R.M.A. (1st appointment), to 1/37th Bde. 14/2/22.
Dobb, Capt. G. C., from 53/2nd Bde., to 32nd Bde. 4/2/22.
Dunphie, 2nd Lieut. C. A. L., from R.M.A. (1st appointment), to 73/5th Bde. 14/2/22.
Durham, Lieut. E. H., M.M., from 14/4th Bde., to 4/4th Bde. 27/1/22.
Flippance, Lieut. S., M.C., from Att. 4th Bde., R.H.A., to 78/11th Bde. 15/2/22.
Foreman, Lieut. H. J., from Att. Irish Cd., to 48/36th Bde. 1/2/22.
Freer, 2nd Lieut. J. G., from R.M.A. (1st appointment), to 24/7th Bde. 14/2/22.
Gairdner, Lieut. C. H., from Att. Irish Cd., to V. Res. Bde. 9/2/22.
Gee, Lieut. A. J., M.C., from Att. Irish Cd., to 81/5th Bde. 24/1/22.
Gee, 2nd Lieut. G. F., from R.M.A. (1st appointment), to 81/5th Bde. 14/2/22.
Goble, Lieut. (Qr.-Mr.) W. R., from South Irish Co. Def., to R.H.A. Depôt, Woolwich. 6/2/22.
Gubbins, Capt. C. Mc.V., M.C., from Staff, to 47/30th Bde. 21/1/22.
Harmar, Lieut. S. F. E., from Att. Irish Cd., to 15/36th Bde. 27/12/21.
Hemmings, Lieut. C. J. E., from Att. Irish Cd., to 37th Bde. 28/1/22.
Hodgson, Lieut. C. F., from Att. Irish Cd., to 78/11th Bde. 28/1/22.
Holt, Lieut. G. W., D.S.O., M.C., from "A" Batty. R.H.A., to R.A. Rid. Est. 9/2/22.
Hopper, Lieut. J. H., from Att. Irish Cd., to 2nd Bde. 28/1/22.
James, Lieut. M. D., from Att. R.E. to 1/37th Bde. 26/1/22.
Jeffery, Lieut. C. H. P., M.C., from Att. Irish Cd., to 1st Bde. 28/1/22.
Johnson, Lieut. A., O.B.E., from Att. Irish Cd., to 1st A.A. Bde. 28/1/22.
Johnson, Major (Bt. Lt.-Col.) R. H., D.S.O., from 141/26th Bde., to 54/10th Bde. 21/1/22.
Lees, Lieut. A. T. O., from Att. Irish Cd., to 35th Bde. 24/1/22.
Lyddon, Lieut. J., from Att. Irish Cd., to 2nd Bde. 28/1/22.
Macnair, Capt. J. L. P., from 77/6th Bde., to Unposted. 31/1/22.
Maconochie, Lieut. H. A., from 2nd Res. Bde., R.G.A., to 10th Bde., R.F.A. 15/2/22.
Matthews, Lieut. A. K., from Att. Irish Cd., to 37th Bde. 24/1/22.
Martin, Lieut. N. T., from W.A.F.F., to 9th Bde. 30/12/21.
Mellett, Lieut. J. A., M.M., from Staff, to 10th Bde. 28/1/22.
Meredew, Lieut. O. W., from Att. Irish Cd., to 15th Bde. 28/1/22.
Napier, Lieut. C. M., from III. Res. Bde., to 15th Bde. 9/2/22.
Neville, Capt. A. G., M.C., from 1st Bde., R.H.A., to 25/35th Bde. 20/1/22.
Nicholls, Major W. A., D.S.O., from Staff, to 52/15th Bde. 14/1/22.
Nichols, Lieut. C. E., from Att. Irish Cd., to 1st Res. Bde. 28/1/22.
Page, Lieut. E. K., M.C., from Att. Irish Cd., to 12th Bde. 26/1/22.
Parham, Lieut. H. J., from Att. Irish Cd., to 37th Bde. 3/2/22.
Paterson, 2nd Lieut. J. F., from R.M.A. (1st appointment), to 137/8th Bde. 14/2/22.

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Postings R.H. & R.F.A.—(Continued).

Paynter, 2nd Lieut. T. C., from R.M.A. (1st appointment), to 15/36th Bde. 14/2/22.
Peel, Lieut. L., from Att. R.A.O.C., 36th Bde. 15/2/22.
Phillips, Lieut. J. R., from Att. Irish Cd., to 30th Bde. 28/1/22.
Robinson, Lieut. C. J., M.C., from R.H.A. Depôt, Woolwich, to R.A. Rid. Est. 9/2/22.
Russell, 2nd Lieut. G. V., from R.M.A. (1st appointment), to 138/8th Bde. 14/2/22.
Sandemann, Lieut. G., from Att. Irish Cd., to 142/36th Bde. 9/2/22.
Saunders-Jacobs, Lieut. H., from Staff, to 86/32nd Bde. 5/1/22.
Sawyer, Lieut. F. G., M.M., from Staff Irish Cd., to 41/31st Bde. 2/2/22.
Sergeant, 2nd Lieut. A. R. D., from R.M.A. (1st appointment), to 75/3rd Bde. 14/2/22.
Shaw-Hamilton, 2nd Lieut. R. J., from R.M.A. (1st appointment), to 65/3rd Bde. 14/2/22.
Smee, Lieut. J. F., from Att. Irish Cd., to 33rd Bde. 28/1/22.
Spencer, Major F. E., D.S.O., M.C., from Staff, India, to Unposted. 27/11/21.
Spendlove, Lieut. W. H., from Staff, Irish Cd., to 146/1st Bde. 1/2/22.
Spurrier, Lieut. R. H., from Att. Irish Cd., to 17/30th Bde. 27/1/22.
Tate, Lieut. J. E., from Att. Irish Cd., to 33rd Bde. 31/1/22.
Templer, 2nd Lieut. C. R., from R.M.A. (1st appointment), to 4/4th Bde. 14/2/22.
Thiele, Capt. N. W., M.C., from 12th Bde., to Unposted. 31/1/22.
Thomas, Lieut. P., from Att. Irish Cd., to II. Res. Bde. 2/2/22.
Tod, Lieut. T. L. G., from Att. Irish Cd., to 12th Bde. 28/1/22.
Vaizey, Lieut. J. T. de H., from Att. Irish Cd., to 35th Bde. 26/1/22.
Vining, Lieut. F. E., M.B.E., from att. Irish Cd., to 4th Bde. 24/1/22.
Voysey, Lieut. J. E., from Att. 2/Loyal Regt., Tidworth, to 35th Bde. 15/2/22.
Wallington, Lieut. B. J., M.C., from Att. R.A.O.C., to Unposted. 15/2/22.
Weigall, Lieut. E. T., from Att. Irish Cd., to 1st Res. Bde. 28/1/22.
Williams, Capt. (Qr.-Mr.) E. E., from R.H.A. Depôt, Woolwich, to No. 1 Depôt, R.G.A. 6/2/22.
Woodrow, Lieut. T. W., from Att. Irish Cd., to 30th Bde. 28/1/22.
Wright, Lieut. P. W., M.C., from Att. Irish Cd., to 36th Bde. 28/1/22.
Yolland, Lieut. J. R., from Att. Irish Cd., to 12th Bde. 24/1/22.

Postings.—R.G.A.

Allcock Lieut. A. W., from Att. Irish Cd., to "D" Co. Batty. 4/2/22.
Arnott, Major R., D.S.O., from 2nd Med. Bde., to Thames & Medway. 18/1/22.
Attwill, Lieut. A. L., from 5th Bde., to Jamaica. 15/2/22.
Aylwin, Capt. S. G., from Att. Irish Cd., to Thames & Medway. 4/2/22.
Bagshawe, Major W. F. M., from Staff, to Thames & Medway. 11/2/22.
Bannatyne, 2nd Lieut. F. W. N., from R.M.A. (1st appointment), to 12/3rd Bde. 14/2/22.
Barlow, Lieut. A. E., from Att. Tanks, to "K" Coast Batty. 24/1/22.
Barrett, Lieut. C. C., from P.A. T. Centre, to 101/21 P.A. 26/1/22.
Barry, Capt. R. J., from Att. Tanks, to Forth Defs. 24/1/22.
Bean, 2nd Lieut. R. L., from R.M.A. (1st appointment), to 10/3rd Bde. 14/2/22.
Bedbrook, Lieut. H., M.M., from Att. Irish Cd., to "D" Co. Batty. 4/2/22.
Blyton, Lieut. A., from Staff, to Unposted. 30/1/22.
Boyle, Lieut. C. L., from Att. Irish Cd., to "E" Coast Batty. 31/1/22.
Brannan, Lieut. W., from Att. Tanks, to Thames & Medway. 24/1/22.
Bridgeland, Lieut. P., from Att. Tanks, to "N" Coast Batty. 24/1/22.
Buckland, Major G. N., D.S.O., from S. Coll. Quetta, to 1st Res. Bde. 28/1/22.
Carr, Capt. C., O.B.E., from Att. Tanks, to Portsmouth. 24/1/22.
Carter, Lieut. I. P., from Att. Tanks, to "A" Co. Batty. 24/1/22.
Cassidy, Lieut. D. M., M.C., from Att. Tanks, to Portsmouth. 24/1/22.
Chapman, Capt. A. C., from Att. Irish Cd., to Dover. 27/1/22.
Cherry, Capt. A. H. M., from Att. Irish Cd., to "P" Co. Batty. 9/2/22.
Clarke, Capt. R. A. O., from Staff, to Att. A.A. Def. School. 15/2/22.
Coleman, Lieut. (D.O.) J. T., from No. 1 Depôt, R.G.A., to Gibraltar. 3/2/22.
Collins, Lieut. T. V., from Att. Irish Cd., to South Irish Co. Defences. 9/2/22.
Connell, Lieut. E. S., M.C., from 1/5th P.A. Bde., to 15/1st P.A. Bde. 11/2/22.
Corbett, Major G. R. de la C., D.S.O., from Att. Irish Cd., to 5th Bde. 27/1/22.
Corbett, Major G. R. de la C., D.S.O., from Att. 5th Bde., to South Irish Co. Defences. 9/2/22.
Courtney, Lt.-Col. F. H., D.S.O., from 6/10th Bde., to Tees & Tyne. 3/2/22.
Cox, Lieut. B. G., from Att. Irish Cd., to "P" Co. Batty. 4/2/22.

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Postings R.G.A.—(Continued).

Crowe, 2nd Lieut. J. P., from R.M.A. (1st appointment), to 34/9th Bde. 14/2/22.
Cruickshank, Major P. H., O.B.E., from Att. Irish Cd., to Portsmouth. 11/2/22.
Davidson, Lieut. A. H., M.M., from Att. Irish Cd., to "O" Co. Batty. 31/1/22.
Dix, Capt. H. A., from Staff, to Portsmouth. 11/2/22.
Donaldson, 2nd Lieut. J. B., from R.M.A. (1st appointment), to 31/8th Bde 14/2/22
Ede, Lieut. A. J., from Att. Irish Cd., to N/Co. Batty. 4/2/22.
Fazil, 2nd Lieut. I., from R.M.A. (1st appointment), to 1st P.A. Bde. 14/2/22.
Foulger, Lieut. F., D.C.M., from Att. Irish Cd., to Mersey Co. Def. 4/2/22.
Farthing, Lieut. H. H., from Att. Tanks, to Thames & Medway. 24/1/22.
Fayrer, Lieut. W. G. J., from Att. Irish Cd., to 2 Res. Bde. 31/1/22.
Fendall, 2nd Lieut. W. P., from 2/P.A. Bde., to 36/9th Bde. 25/1/22.
Fleetwood, Lieut. G. F., from Att. Irish Cd., to "G" Co. Batty. 31/1/22.
Foster, Lieut. R. D., from Att. Irish Cd., to 10th Bde. 30/1/22.
Gaussen, Capt. B., from Att. Irish Cd., to Portsmouth. 31/1/22.
Goldney, Capt. R. M., from Portsmouth, to "F" Co. Batty. 1/2/22.
Goodman, Lieut. R., D.C.M., from Att. Tanks, to Harwich. 24/1/22.
Goodwin, Lieut. E. A., from Att. Irish Cd., to "J" Co. Batty. 9/2/22.
Grant, Lieut. J. L., from Att. Irish Cd., to "O" Co. Batty. 31/1/22.
Griffin, Lieut. C. C., from Att. Irish Cd., to "I" Co. Batty. 9/2/22.
Gulland, Capt. A. H., from Staff, to "A" Coast Batty. 26/1/22.
Hall, Capt. A. C. S., from Staff, to Unposted. 26/1/22.
Hall, Capt. F. W., M.C., from Att. Irish Cd., to Tees & Tyne. 24/1/22.
Hanlon, Capt. D. R., from Att. Irish Cd., to North Irish Co. Defences. 9/2/22.
Hayes-Sadler, Lt.-Col. J., from Thames & Medway, to 23/P.A. Bde. 29/12/21.
Healing, Major N. C., D.S.O., M.C., from 10th Bde., to 532/1st Res. Bde. 11/2/22.
Herbert, 2nd Lieut. E. O., from R.M.A. (1st appointment), to 38/10th Bde. 14/2/22.
Horwood, 2nd K., from R.M.A. (1st appointment), to 2/1st P.A. Bde. 14/2/22.
Howard, 2nd Lieut. E. A., from R.M.A. (1st appointment), to 29/8th Bde. 14/2/22.
Huxford, Lieut. E. H., M.C., from Att. Irish Cd., to Thames & Medway. 31/1/22.
Jackson, Lieut. L. H., from Att. Irish Cd., to "J" Co. Batty. 31/1/22.
Jones, Lieut. C. W. F., from Att. Irish Cd., to 8th Bde. 31/1/22.
Jutilane, Lieut. J., from Att. Irish Cd., to "K" Co. Batty. 31/1/22.
Knight, Lieut. W. T., M.C., from Att. Tanks, to Dover. 24/1/22.
Lane, Major H. E., from Att. Irish Cd., to "L" Co. Batty. 9/2/22.
Langley, Major A. W., D.S.O., M.C., from Att. Irish Cd., to "B" Coast Batty. 30/1/22.
Lawn, Lieut. E. J., from Att. Irish Cd., to "E" Co. Batty. 28/1/22.
Le Gassick, Lieut. F. N., M.C., from Att. Irish Cd., to South Irish Co. Defences. 9/2/22.
Lewis, Lieut. F. W., M.M., from Att. Tanks, to "G" Co. Batty. 24/1/22.
Lilly, Lieut. J., from Att. Tanks, to Tees & Tyne. 24/1/22.
Loughborough, Major A. H., O.B.E., from Staff, to 7/2nd Bde. 23/12/21.
Luker-Brown, Lieut. W. G. A., from Att. Irish Cd., to South Irish Co. Defences. 9/2/22.
Lyle, Capt. (D.O.) J., from Cape Town, to Mersey Co. Def. 13/2/22.
Maffett, Lieut. W. V. C., from Att. Irish Cd., to North Irish Co. Defences. 4/2/22.
Mair, Capt. W., from Att. Irish Cd., to No. 1 Depôt. 31/1/22.
Maxwell, Major W. W., from Aden, to "G" Co. Batty. 15/2/22.
Moody, Lieut. W., M.C., from Att. Irish Cd., to "P" Co. Batty. 31/1/22.
Nunn, Lieut. W. J., M.C., from Att. Irish Cd., to Portsmouth. 31/1/22.
Oliver, Lieut. H. H. M., M.C., from Att. Tanks, to "C" Co. Batty. 24/1/22.
Owen, Capt. (D.O.) R. A., from Unposted, to Thames & Medway. 11/2/22.
Palmer, Capt. (Qr.-Mr.) W., from Forth Co. Def., to South Irish Co. Defences. 6/2/22 .
Pepper, Major J. W., from Att. Irish Cd., to Bermuda. 17/1/22.
Perrott, Lieut. R. O., from 79th Company, to 94th Company. 26/1/22.
Peters, Lieut. J., D.C.M., from Att. Irish Co., to "E" Co. Batty. 1/2/22.
Phillips, 2nd Lieut. C., from R.M.A. (1st appointment), to 2nd P.A. Bde. 14/2/22.
Ponder, Lieut. S. E. G., M.C., from P.A.T. Centre, to 17/23rd P.A. 26/1/22.
Quickenden, Lieut. R. F., from Att. Tanks, to "F" Co. Batty. 24/1/22.
Richey, Lt.-Col. F. W., D.S.O., from N. Scottish, to 21/P.A. Bde. 29/12/21.
Ridlington, Lieut. E. C., from Att. Irish Cd., to 1st Res. Bde. 31/1/22.
Rowe, 2nd Lieut. S. E., from R.M.A. (1st appointment), to 2/1st Bde. 14/2/22.
Rowett, Capt. R. B., from Att. Irish Cd., to South Irish Co. Defences 9/2/22.
Sargeaunt, Capt. P. R., D.S.O., from 94th Co., Rangoon, to Adjt. R.G.A., Rangoon. 7/11/21.

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Postings R.G.A.—(Continued).

Saunders, 2nd Lieut. M. D. S., from R.M.A. (1st appointment), to 2/P.A. Bde. 14/2/22.
Saunders-Jacobs, Lieut. A. B., from Att. Irish Cd., to 10th Bde. 1/2/22.
Scarlett, Major (Bt. Lt.-Col.) J. A., D.S.O., from 11th Bde., to 1st D.A.C. 17/1/22.
Sexton, Lieut. A., from Att. Tanks, to Portsmouth. 24/1/22.
Shadbolt, Capt. C., from Att. Irish Cd., to Thames & Medway. 31/1/22.
Shrive, Lieut. R., M.C., from Att. Tanks, to "E" Co. Batty. 24/1/22.
Skinner, Capt. R. O., from I.O.D., to 15/4th Bde. 17/1/22.
Stebbing, Capt. H. T., from Att. Irish Cd., to South Irish Co. Defences. 1/2/22.
Symonds, 2nd Lieut. E. N. C., from Att. Tanks, to Thames & Medway. 24/1/22.
Stearn, Lieut. G. F., from Att. Tanks, to "F" Co. Batty. 24/1/22.
Swan, Lieut. O., from Att. Irish Cd., to "M" Co. Batty. 3/2/22.
Tennant, 2nd Lieut. T. L. B., from R.M.A. (1st appointment), to 1/1st Bde. 14/2/22.
Titmas, Lieut. T. W. L., from Att. Irish Cd., to 1st Bde. 28/1/22.
Uden, Lieut. A. J., from Att. Irish Co., to "C" Co. Batty. 31/1/22.
Wakefield, Lt.-Col. T. M., D.S.O., from Hong Kong-Sing. Battalion, to Command R.G.A., Singapore. 15/2/22.
Watkinson, Lieut. G. L., from 21/P.A. Bde., to P.A.T. Centre. 26/1/22.
Wood, Capt. R., from Att. Irish Cd., to "L" Co. Batty. 31/1/22.
Woods, Lieut. J., from Att. Tanks, to Dover. 28/1/22.
Whyte, Major T. A., from Att. Irish Cd., to "D" Co. Batty. 9/2/22.

Staff Appointments.

Royal Horse and Royal Field Artillery.

Archer, Capt. R. A., M.C., Att. Tank Corps, India. 3/12/21.
Dawson, Lieut. W. C. P., Intelligence Officer, Constantinople. 3/1/22.
Haining, Major (Bt. Lt.-Col.) R. H., D.S.O., D.A.A.G., Staff College, Camberley. 28/1/22.
Howard, Capt. E. S. G., M.C., Co. Officer Royal Military Academy. 1/2/22.
Jones, Lieut. G. H., King's African Rifles. 2/12/21.
Massey, Major H. R. S., D.S.O., M.C., Bde. Major R.A., 5th Division. 20/1/22.
Monckton, Lieut. T. C. C., G.S.O., 3rd Grade, Iraq. 20/9/21.

Royal Garrison Artillery.

Adams, Major (Bt. Lt-Col.) L. C., C.B.E., Asst. Superintendent Design, Woolwich. 19/9/21.
Brown, Capt. L. N. F., D.S.O., Egyptian Army. 17/12/21.
Graham, Major R. C. D., D.S.O., D.A.A.G., Army Hd. Qrs., India. 28/11/21.
Guise, Capt. V. R., M.C., Att. Tank Corps, India. 6/12/21.
Nugent, Major (Bt. Lt.-Col.) W. V., C.B.E., D.S.O., G.S.O., 2nd Grade, Staff College, Camberley. 9/1/22.
Parkes, Lieut. G., Att. Tank Corps. 20/12/21.
Penny, Lieut. M. G., Seconded to R.A.F. 20/1/22.

1st Appointments.

2nd Lieuts. on first appointment from Royal Military Academy dated 22nd December, 1921.

R.H. & R.F.A.

Dalton, C. J. G.
Daniell, R. B. T.
Shaw-Hamilton, R. J.
Dunphie, C. A. L.
Gee, G. F.
Bland, H. O. C.
Russell, G. V.
Paterson, J. F.
Templer, C. R.
Freer, J. G.
Colchester, G.
Carden, R. H. L.
Paynter, T. C.
Armstrong, P. F. B. N
Serjeant, A. R. D.

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1st Appointments.—(Continued).

R.G.A.

Rowe, S. E., with seniority from 18/11/1918.
Donaldson, J. B.
Bean, R. L.
Phillipps, C.
Horwood, K.
Bannatyne, F. W. N.
Fazil, I.
Saunders, M. D. S.
Crowe, J. P.
Howard, E. A.
Tennant, T. B. L.
Herbert, E. O.

Promotions (Regimental).

Courtney, Major F. H., to be Lt.-Col. R.G.A. 29/1/22.
Cowie, Major D. G., to be Lt.-Col. R.G.A. and to remain seconded. 29/1/22.
Evans, Major C. L., to be Lt.-Col. R.G.A. 17/1/22.
Haslewood, 2nd Lieut. W. G., to be Lieut R.G.A. 13/7/21 with seniority. 15/11/19.
Hayes-Sadler, Major J., to be Lt.-Col. R.G.A. 28/1/22.
Holmes, 2nd Lieut. G. D., to be Lieut. R.F.A. 17/12/21.
How, 2nd Lieut. C. G., to be Lieut. R.F.A. 18/12/21.
Ogilvie, Major (Bt. Lt.-Col.) G., C.M.G., to be Lt.-Col. R.G.A. and remains seconded. 29/1/22.
Symonds, 2nd Lieut. E. N. C., M.C., to be Lieut. R.G.A. 27/8/21 with seniority 3/2/1918.
Wakefield, Major T. M., D.S.O., to be Lt.-Col. R.G.A. 29/1/22.
Yates, 2nd Lieut. M., to be Lieut. R.F.A. 18/12/21.

Honours.

Perceval, Maj.-Genl. E. M., C.B., D.S.O. (R.P.) to be K.C.B. 2/1/22.
Gorton, Col. R. St. G., to be C.B. 2/1/22.
Dreyer, Col. J. T., D.S.O., to be C.B. 2/1/22.
Patch, Col. F. R., C.M.G., D.S.O., to be C.B. 2/1/22.

To Temporary Half-Pay.

Barton, Lt.-Col. R. L., D.S.O., R.G.A., temp. half-pay on account of ill health. 28/1/22.
Brittan, Lieut. E. M. G., R.F.A., temp. half-pay on account of ill health. 19/12/21.
Fowler, Lieut. A. S., M.C., R.F.A. 25/1/22.
Keogh, Lt.-Col. T. M., R.G.A. 29/1/22.
Lane, Lieut. T. W., R.F.A., temp. half-pay on account of ill health. 28/12/21.
Nugent, Lt.-Col. G. R. H., O.B.E., R.G.A. 29/1/22.

To Half Pay List.

Cunliffe-Owen, Lt.-Col. F., C.M.G., on termination of appointment. 20/9/21.
Disney, Major J. W. K., temp. half-pay on account of ill health. 17/12/21.
Edwards, Major L. C., O.B.E., on account of ill health. 15/2/22.
Ingpen, 2nd Lieut. R. L. L., on account of ill health. 17/12/21.
McCall, Capt. A. G., on appointment to Indian Civil Service. 5/8/21.

Transfers.

Maconochie, Lieut. H. A., R.G.A., to R.F.A. next above Lieut. E. J. Paton-Walsh, R.F.A. 15/2/22.

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Retirements on Retired Pay.

Carey, Col. G. G. S., C.B., C.M.G., with Hon. rank of Major General. 8/1/22.
Castle, Lt.-Col. R. W., C.M.G., D.S.O., R.G.A. 17/1/22.
Hemus, Lieut. A. O., from half-pay. 2/2/22.
Maclaverty, Major C. F. S., D.S.O., R.F.A., as Lt.-Col. 31/1/22.
Maples, Capt. J. C., M.C., from temp. half-pay on account of ill health caused by wounds. 15/2/22.
Mayne, Col. H. B., D.S.O., from half-pay to retired pay. 7/1/22.
Molesworth, Col. H. E., C.M.G., D.S.O., from half-pay list. 14/2/22.
Murphy, Lieut. F. G. A., from half-pay with rank of Captain. 4/2/22.
Sedgwick, Lt.-Col. F. R., C.M.G., D.S.O., from half-pay list. 7/2/22.
Wilkins, Major G. H. C. 7/2/22.

Correction.

Butchart, Major J. A., D.S.O., Retired Pay 2/12/21, with rank of Lt.-Col.

Retirements with a Gratuity.

Barraclough, Lieut. A. J., D.C.M., R.F.A. 21/1/22.
Hogarth, Lieut. W., R.G.A. 21/1/22.
Inchbald, Capt. P. E., M.C. 1/2/22.
Ollett, Lieut. H. A., R.F.A., as Capt. 24/1/22.
Warner, Lieut. E. P., R.F.A. 31/1/22.

Resignations.

Godfrey, Lieut. J. M., R.F.A. 25/1/22.
Macfarlane, Lieut. R. M. C., M.C., R.F.A., Resigned on appointment to permanent Commission R.A.F. 17/11/21.
Maitland, Lieut. C. E., D.F.C., R.G.A., Resigned on appointment to permanent Commission R.A.F. 17/11/21.
Mills, Lieut. H., R.F.A. 20/1/22.
Nicoll, Capt. D. A., R.F.A. 25.1.22.

Resignation Cancelled.

Hardie, Lieut. A. S., R.F.A.

Deaths.

Allen, Major Edward, M.C. (R. of O.) 23/12/21.
Challenor, Col. G. R., late R.A. 24/1/22.
Cleeve, Major General W. F., C.B. 31/1/22.
Probyn, Major D. G. (R.P.) 29/1/22.
Wogan-Browne, Lieut. J. H. 10/2/22.

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*English-Italian and Italian-English Naval and Military Terms. Compiled by Major M. C. Maunsell, late R.A. London, 1918. (Plus postage).	4	6
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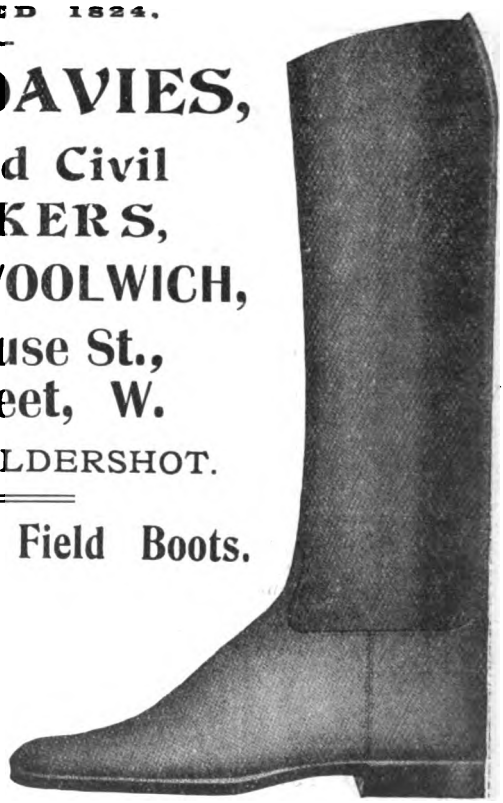

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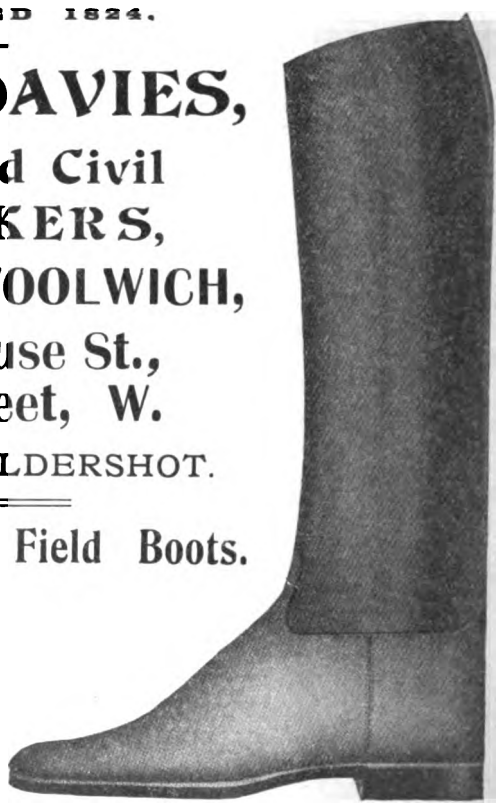

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